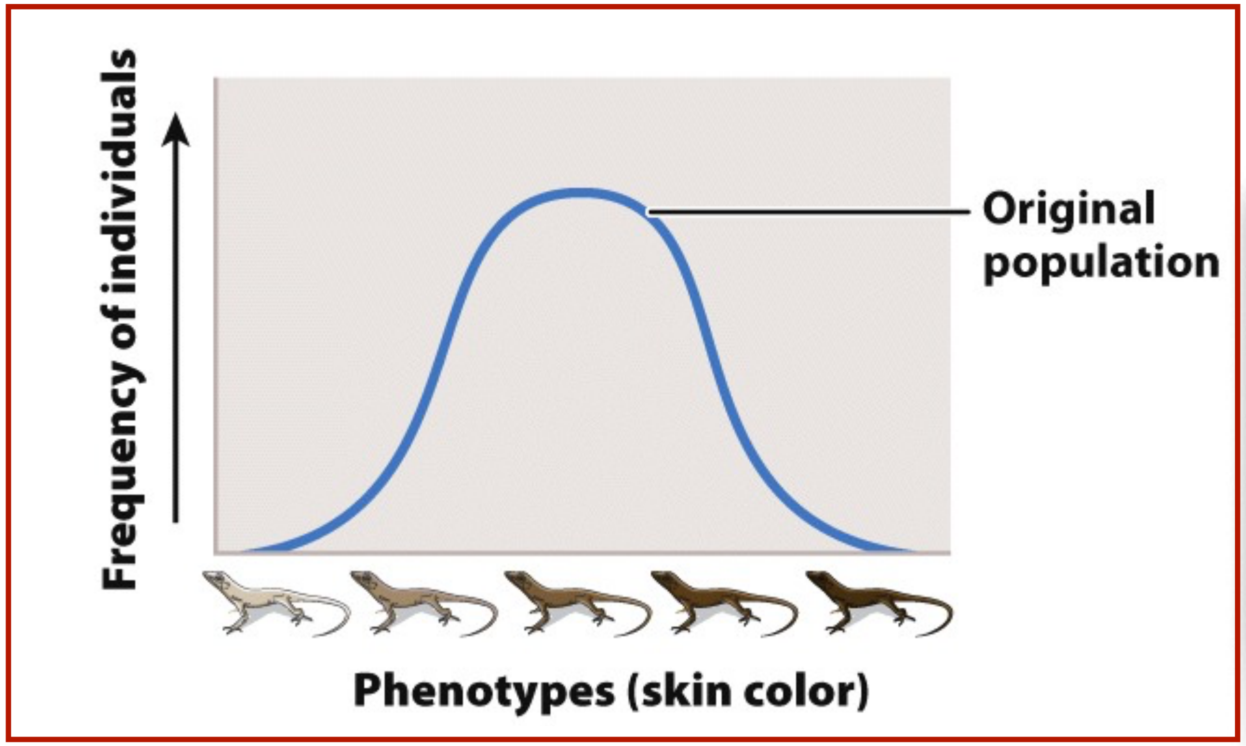
BIOL2107, Fall '23

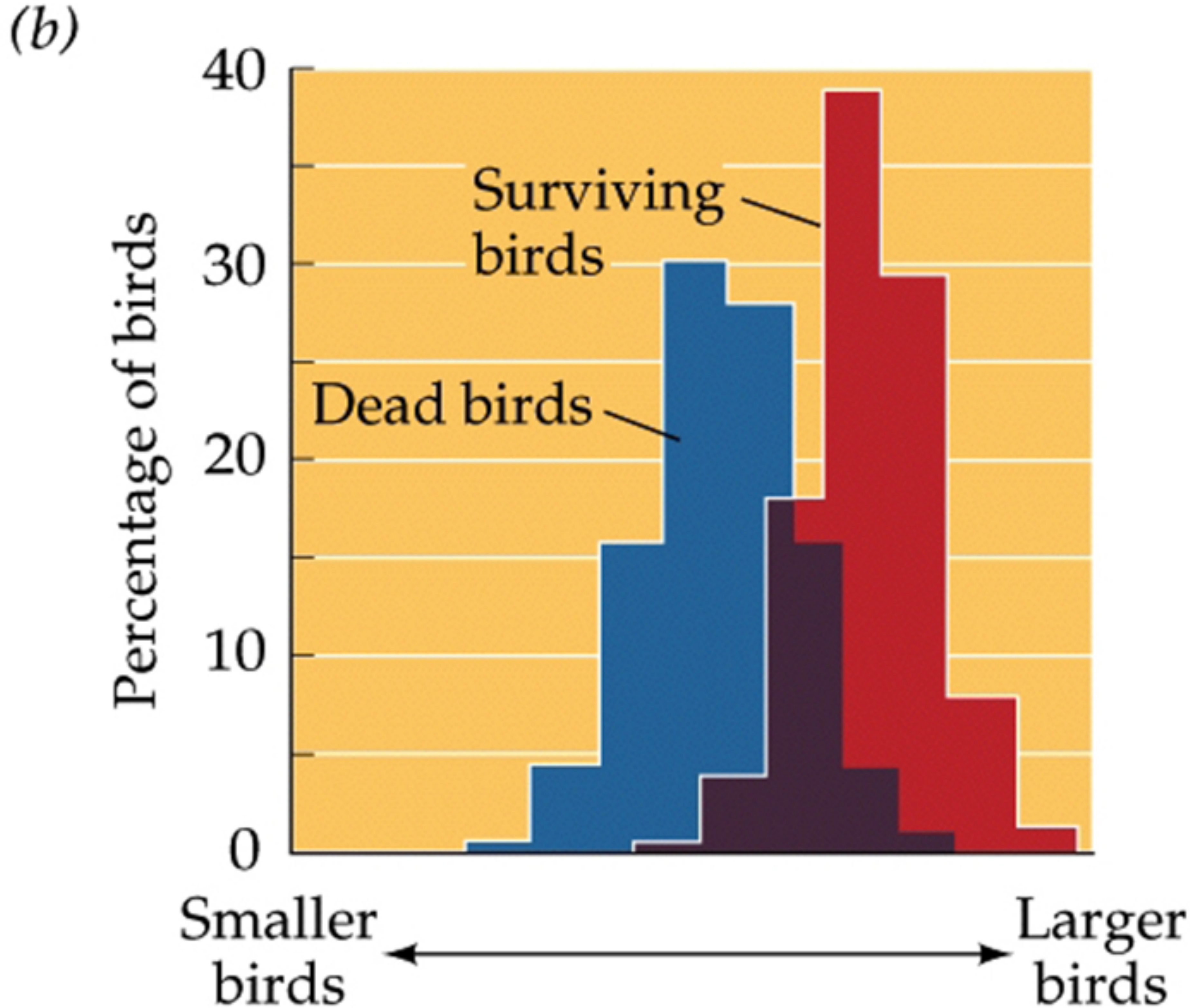
Lecture 4

Bell Curve

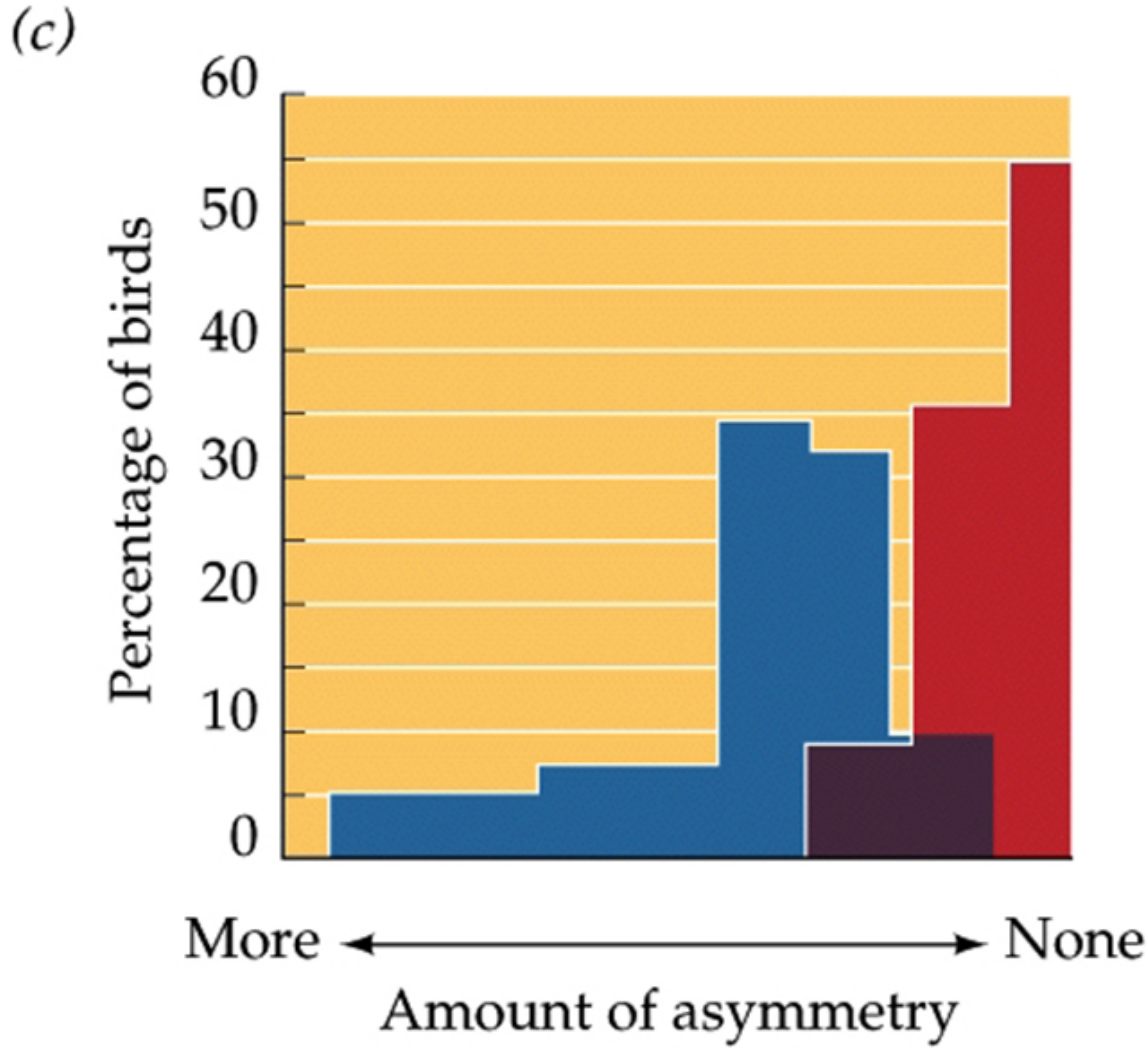


How does selection affect this distribution of phenotypes in three environments in which the background colors differ? In each case, lizards that are camouflaged against the background survive and reproduce whereas those that do not are eliminated by predators.

Cliff swallows in Nebraska 1991- 6



Cliff swallows in Nebraska


(c)
60
50
40
30
20
10
0
Percentage of birds
More
None
Amount of asymmetry

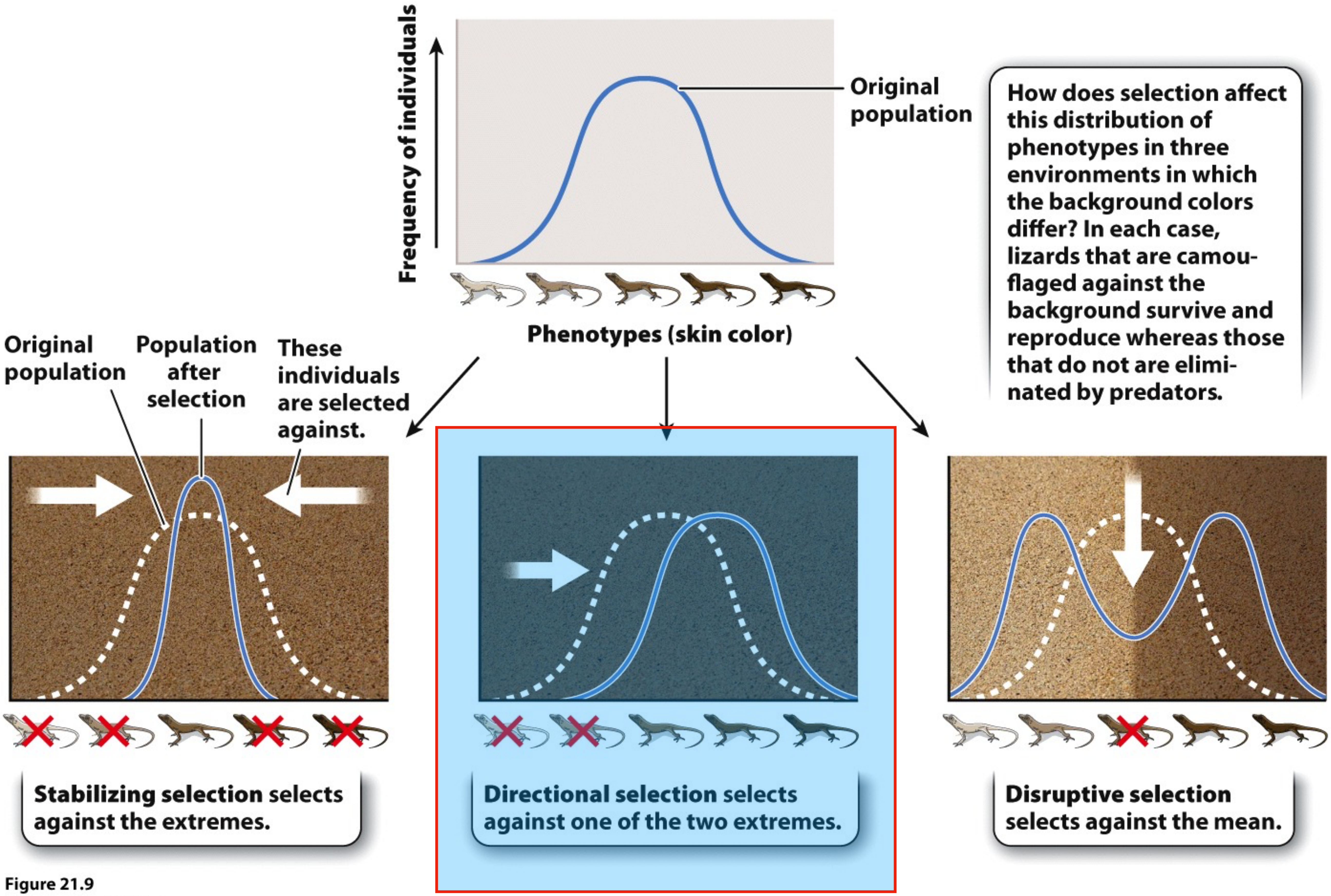


Figure 21.9
Biology: How Life Works

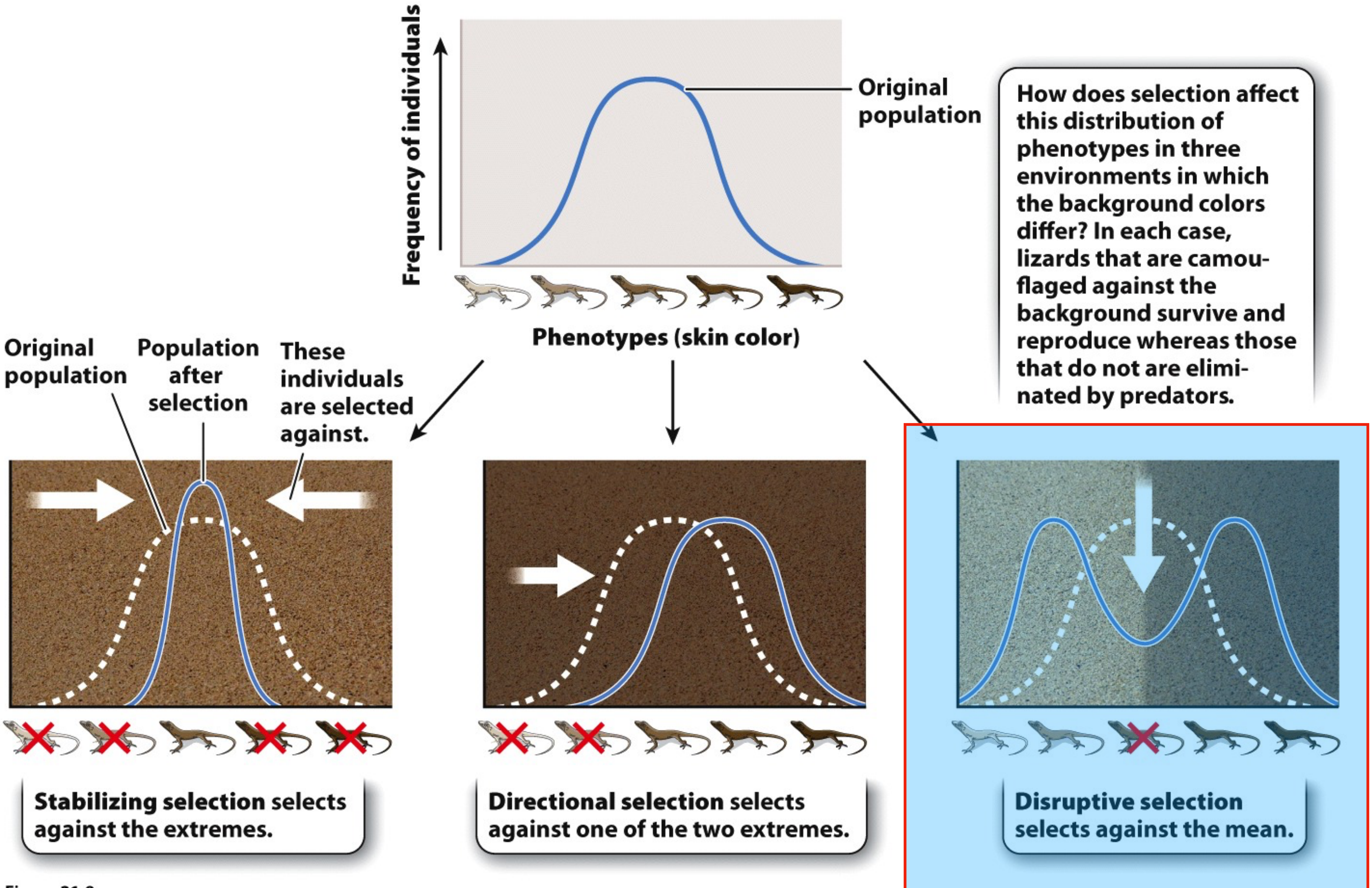
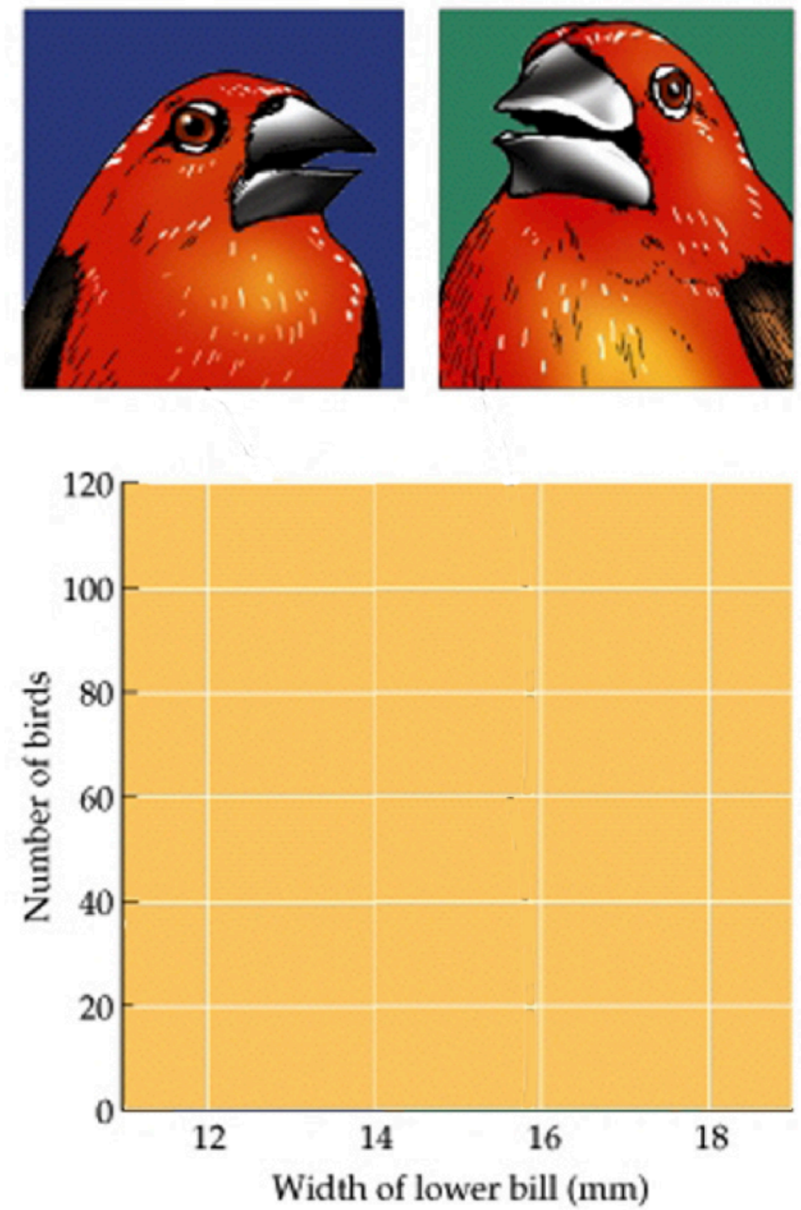


Figure 21.9
Biology: How Life Works

Black-bellied seedcracker



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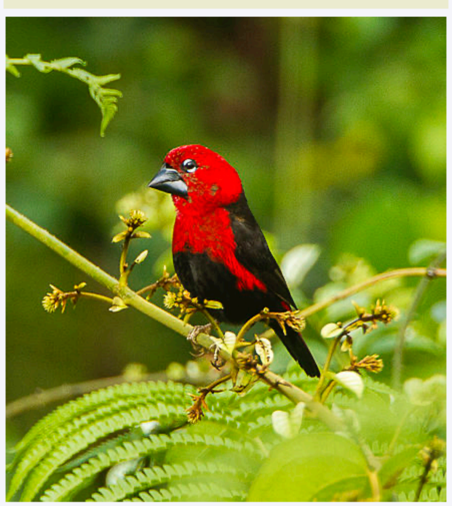
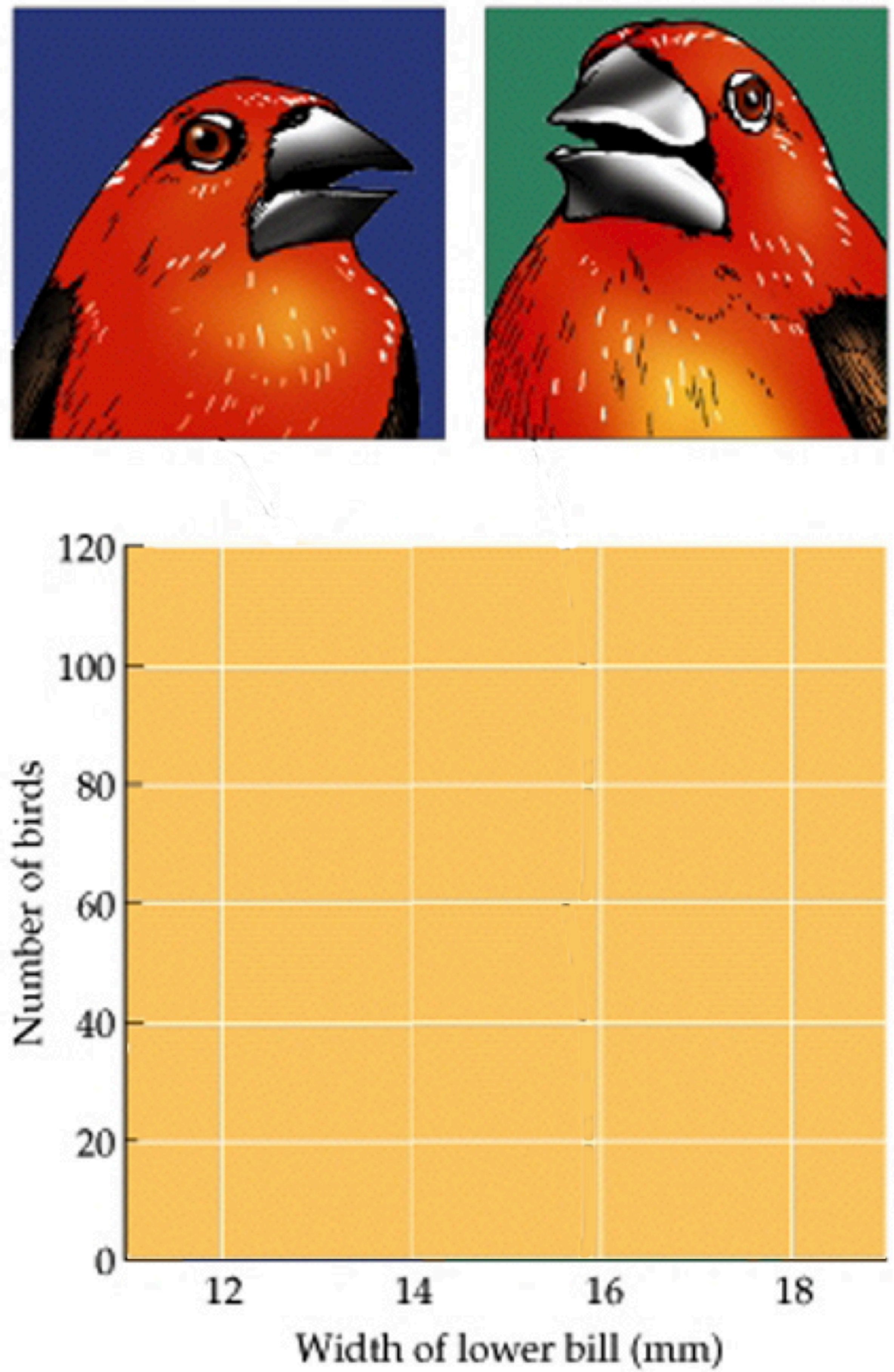
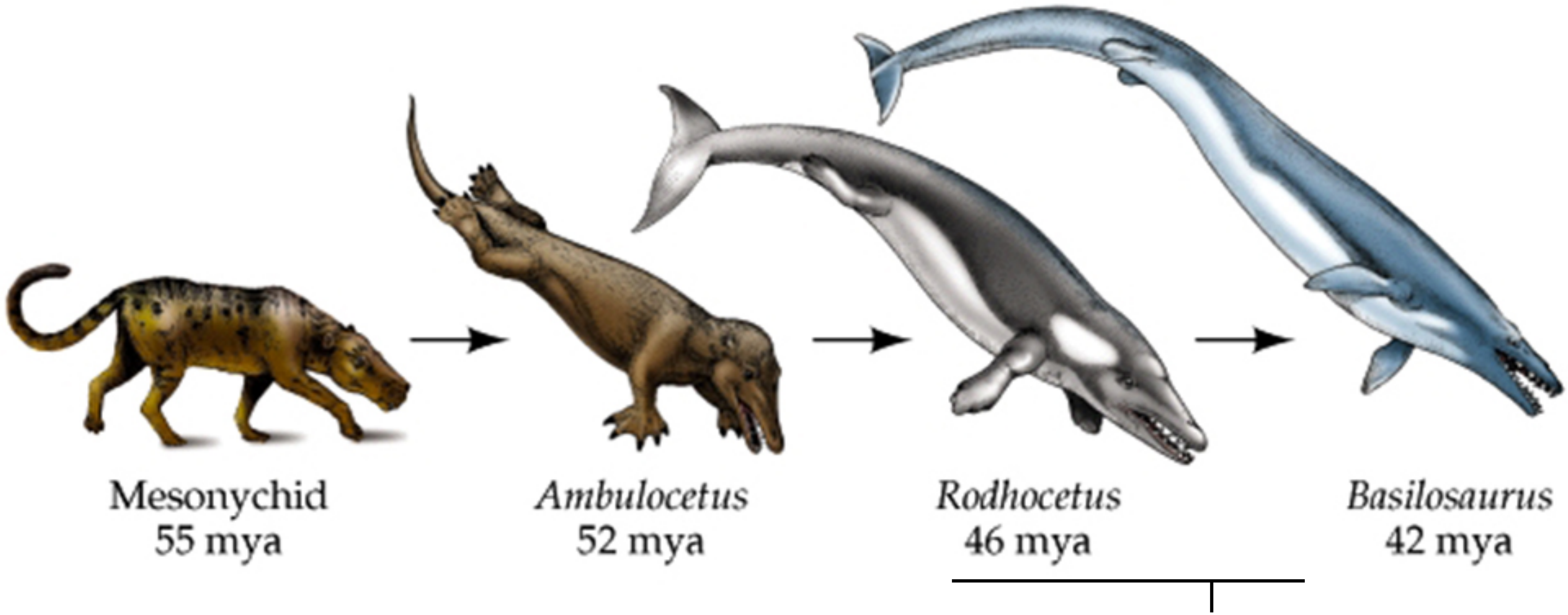
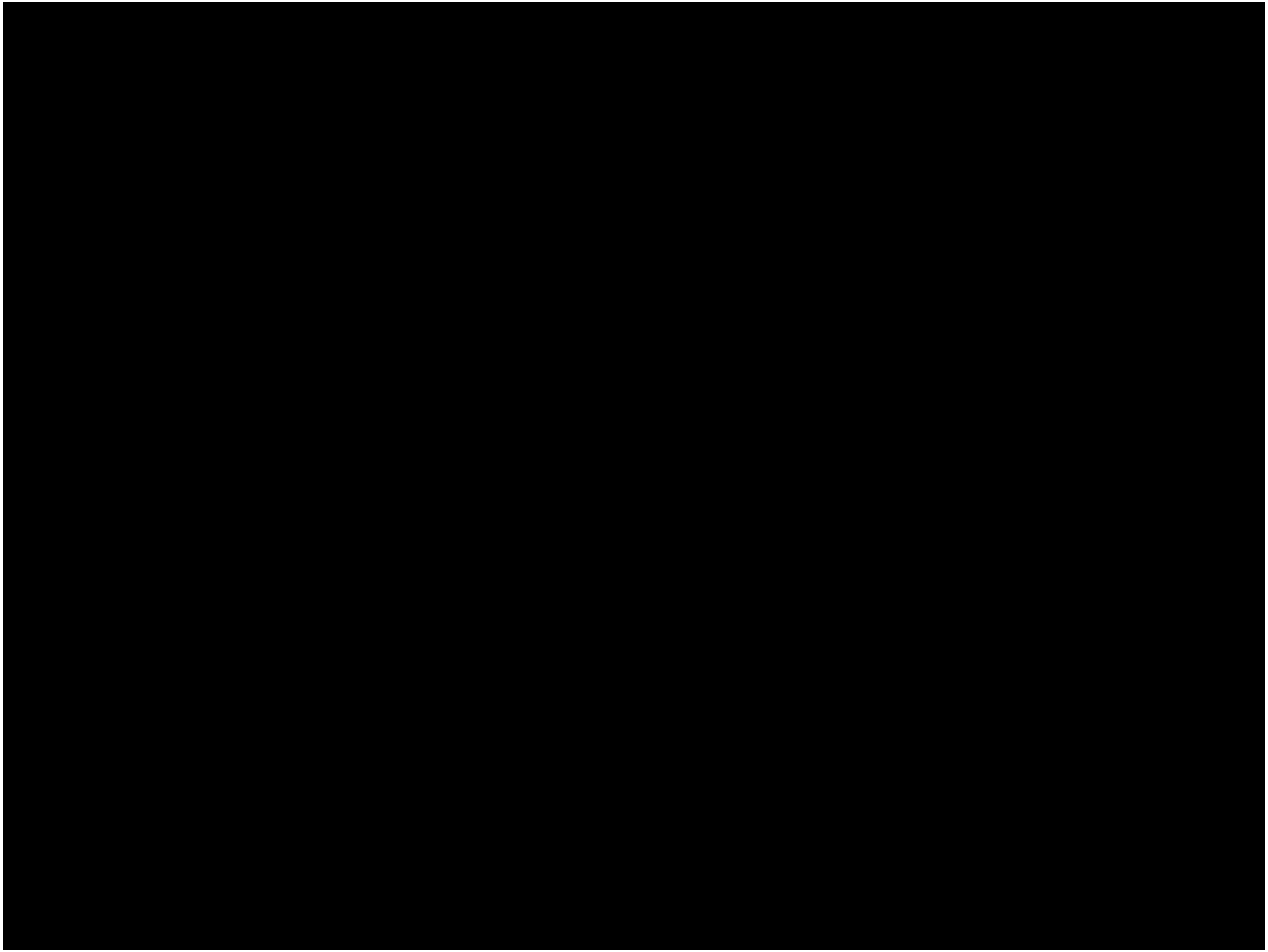






Fossil Records… Evolution of Whales?

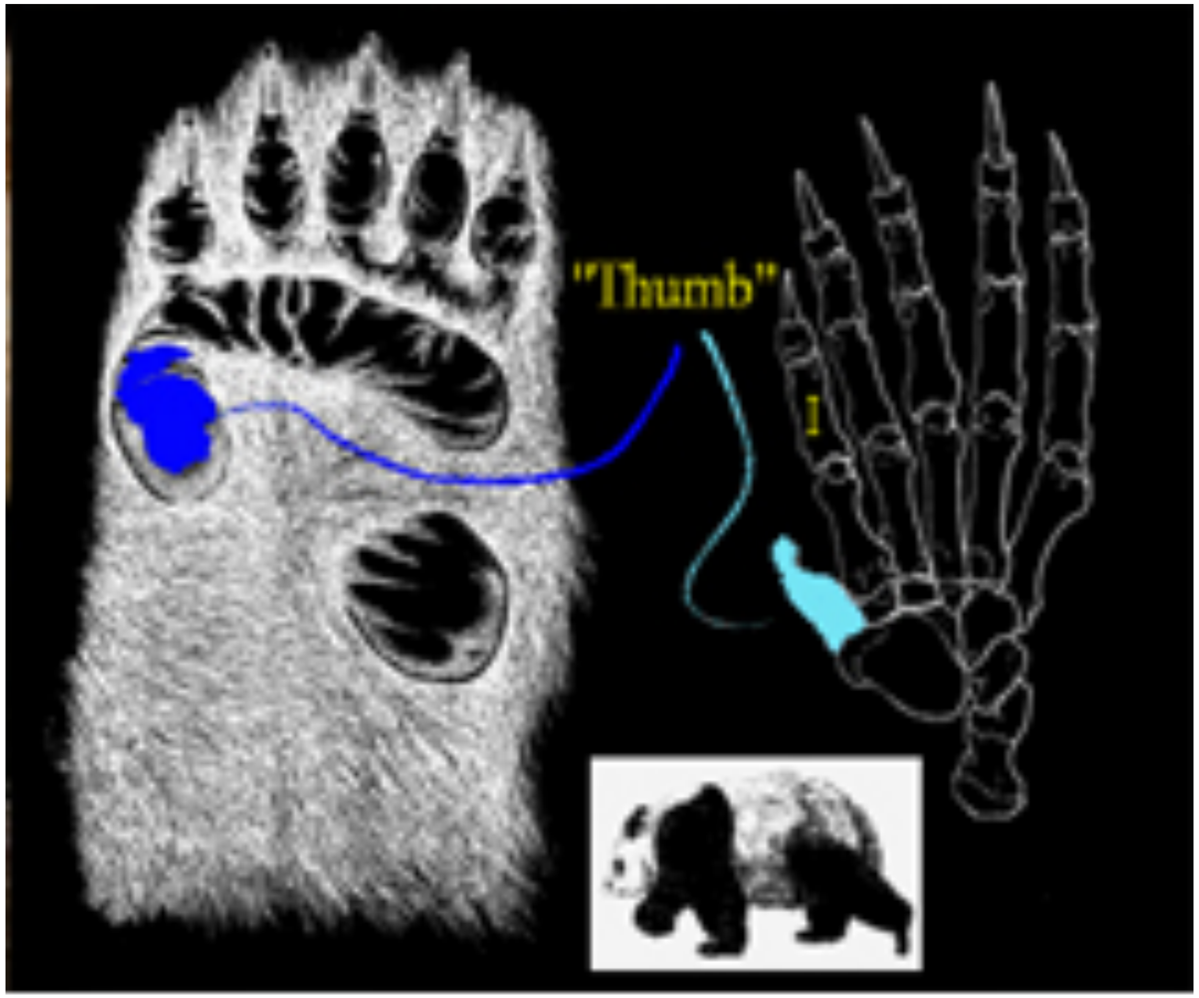
Phiomicetus anubis

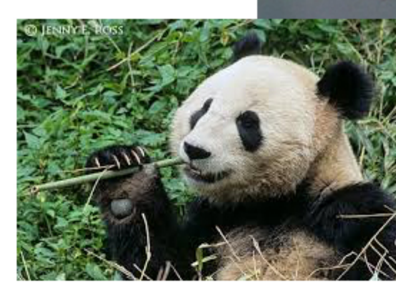


Fossil Records… Lucy?

Fossil Records…

Fossil Records… Panda’s thumb





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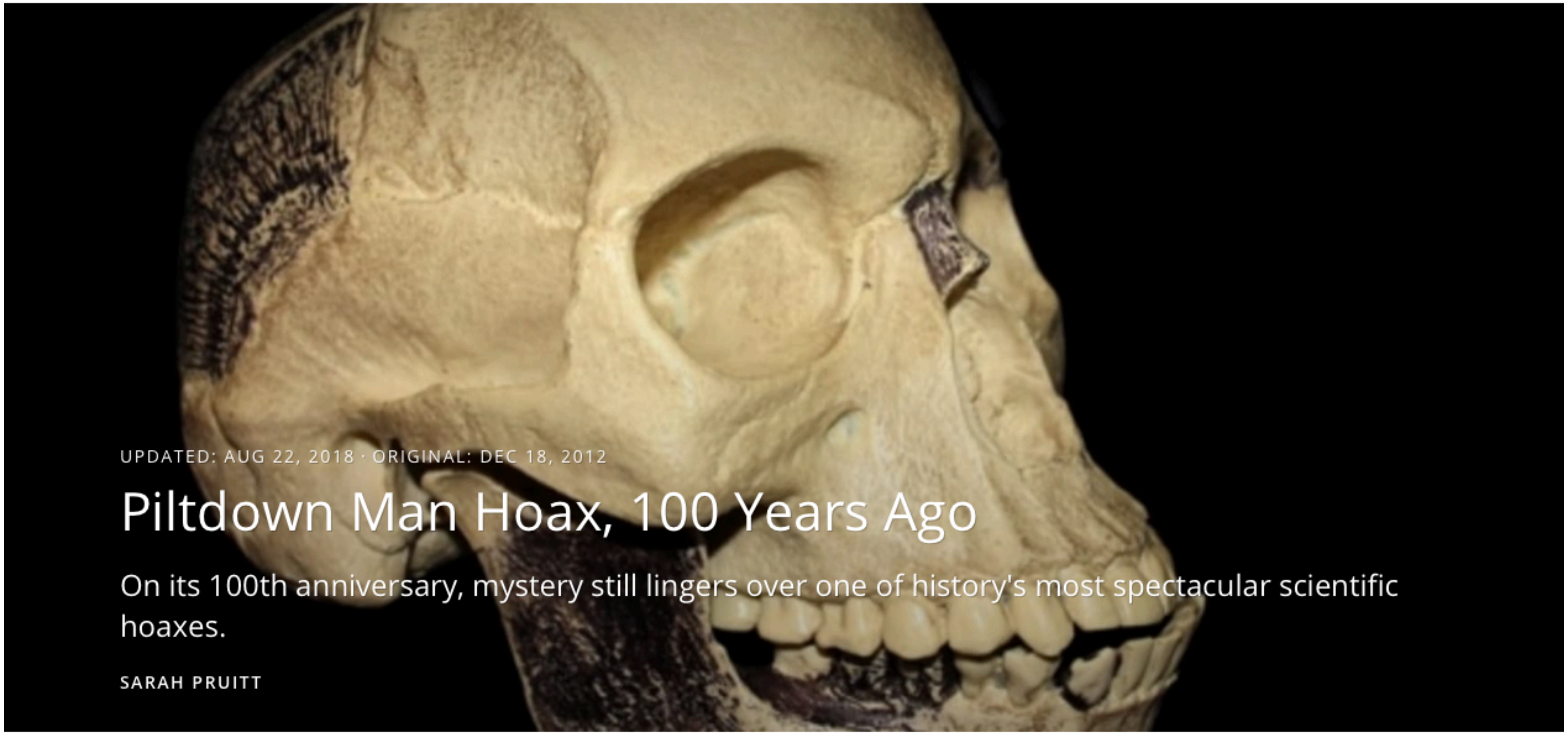
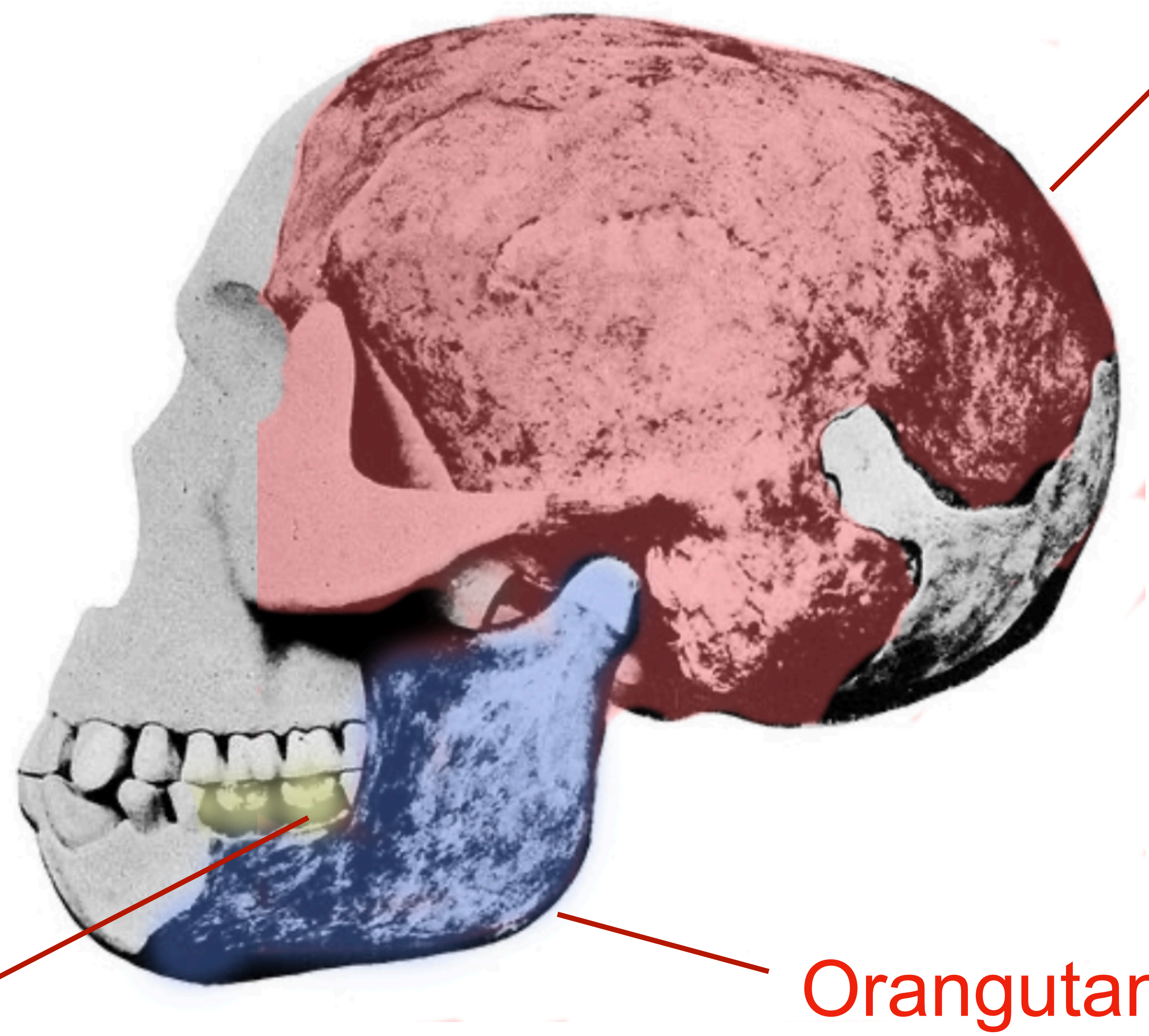


By the time of Dawson and Woodward's historic announcement, the search for a missing link to prove Darwin's still-controversial theory had grown intense. Significant evidence of early humans in the British Isles had not yet been found, and the success of the Sussex dig was a major headline-grabber. Woodward, who was the curator of the British Museum's paleontology department, dubbed the discovery Eoanthropus dawsoni, or "Dawson's Dawn-man," but he was more commonly known as the Piltdown Man.

1912

Falsified Fossil Records…



Falsified Fossil Records…


GALLAPAGOS ISLANDS
Discovered and Described
by Capt. Cowley in
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Lord Wenman's
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Bindloss's Isl.
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Natural Selection: ”the gradual process by which heritable biological traits become either more or less common in a population as a function of the effect of inherited traits on the differential “reproductive success” of organisms interacting with their environment"

Genetic/Evolutionary Vocabulary

- **population:** all individuals of the same species occupying the same area.

- **gene:** A unit of heritable information -usually associated (at the molecular level) with a specific region located on the chromosome.

- **allele:** one of two or more slightly different forms, or "variants" of a given gene.

- **allelic frequency:** the number of times a particular allelic variant shows up -usually refers to a population

- **genotype:** a selection of the genes that make up an individual.

- **phenotype:** the consequence(s) of all the allelic interactions that give rise to a visibly determinable "type".

- **gene Pool:** a collection of the different genes (both expressed and not expressed) that are present in a population

To understand what **populations** are and how they can change…

We need to understand that populations are "populations of individuals" not a group of identical **"clones"**. ..

Populations are a group of individuals that exhibit an assorted array of similar **phenotypic traits** (the operative word being **"similar"**), and that each individual has a slightly different organismal **"signature"** that contributes to the collective "**gene pool**”

Consider a newly introduced **allele** within a population. The presence of this **allele** will have an **allelic frequency** that can change over time.

At some stage, perhaps, the frequency of a particular **allele** would become either “fixed” in a population or “lost” from a population for one reason or another.

This can happen rapidly or need not happen at all -especially in large populations.

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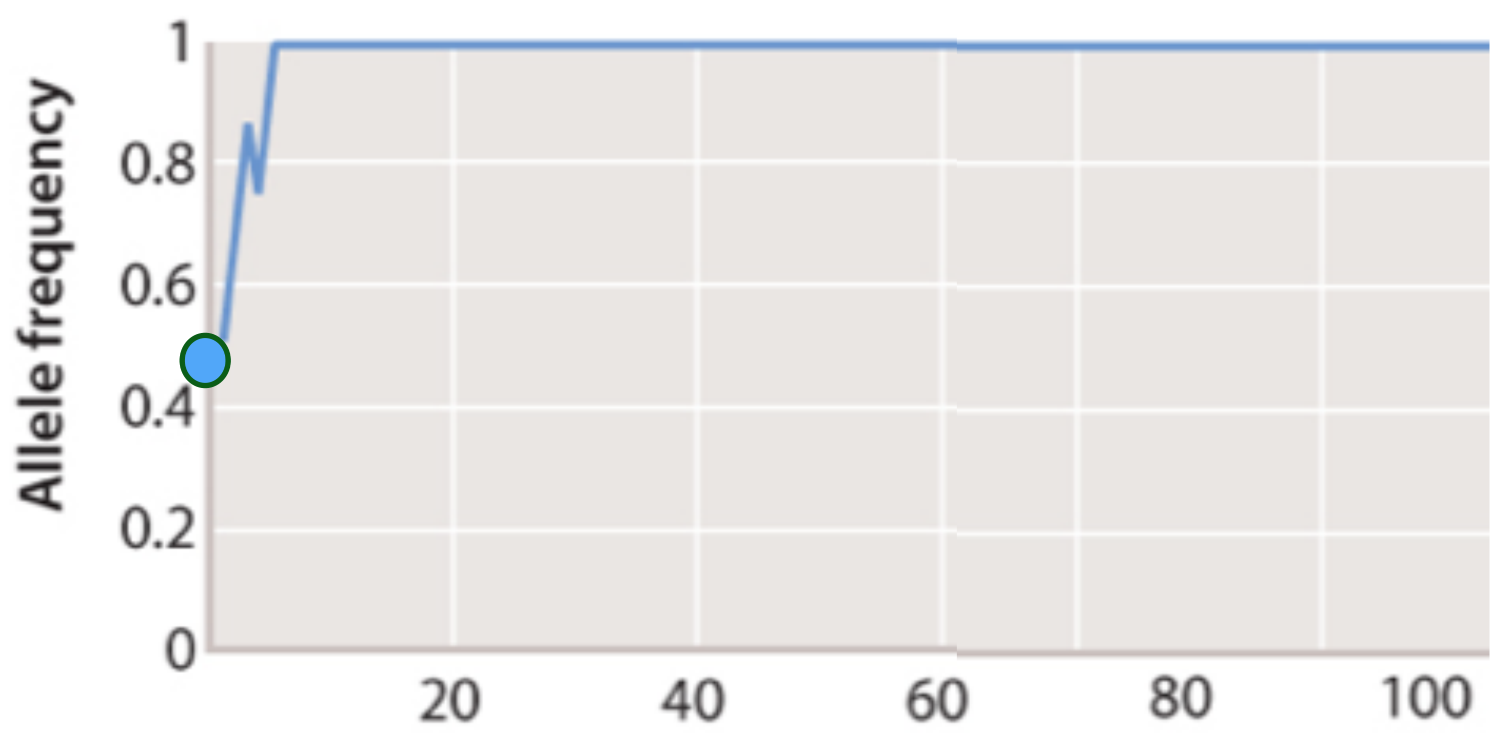

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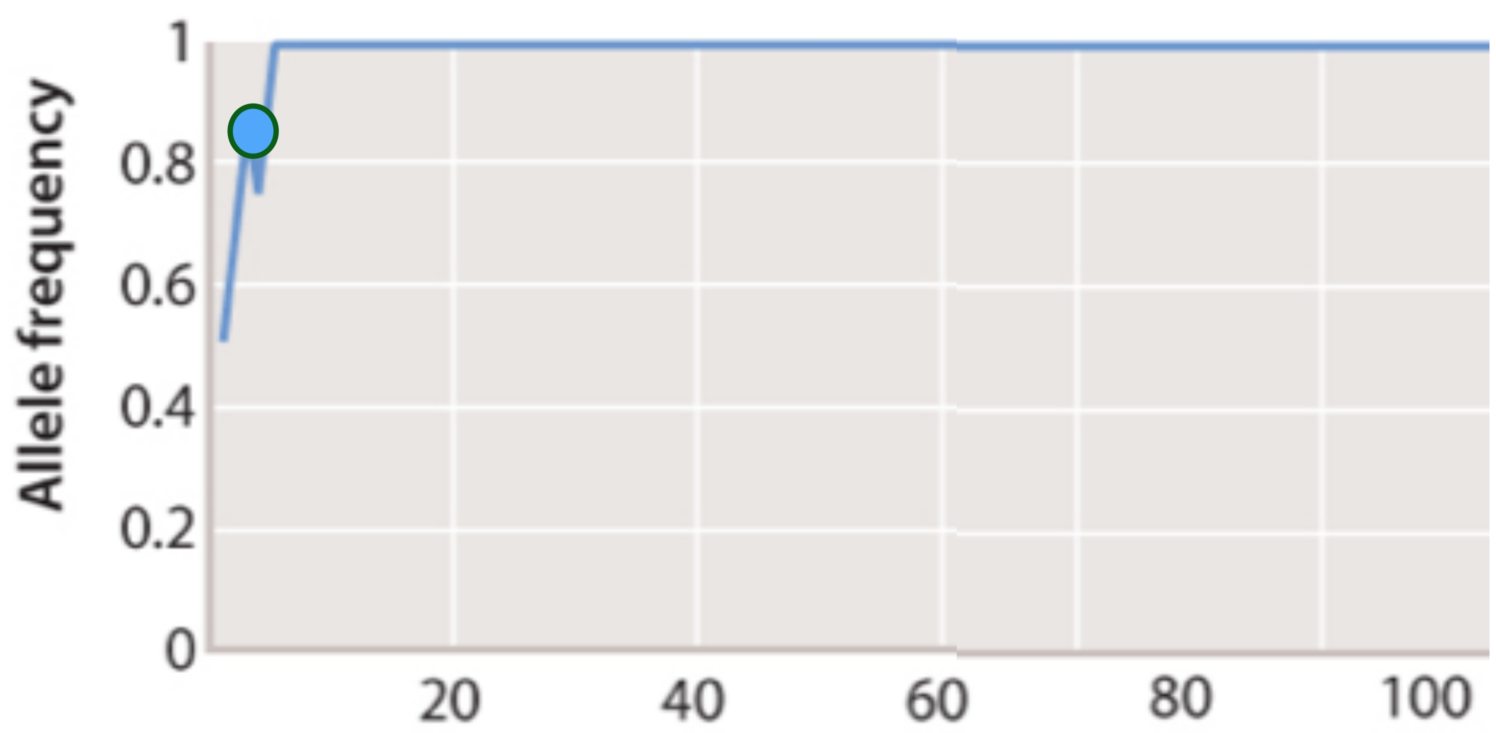

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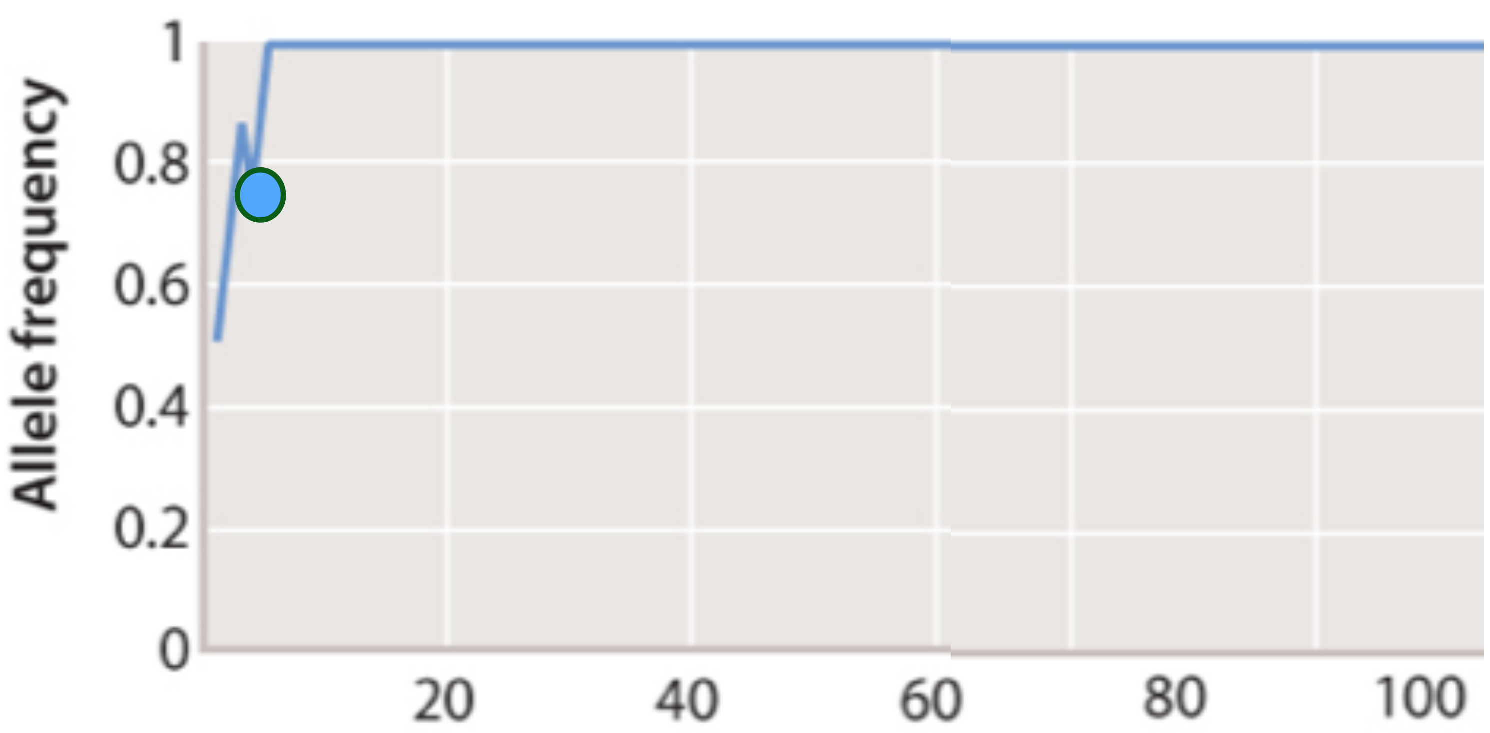

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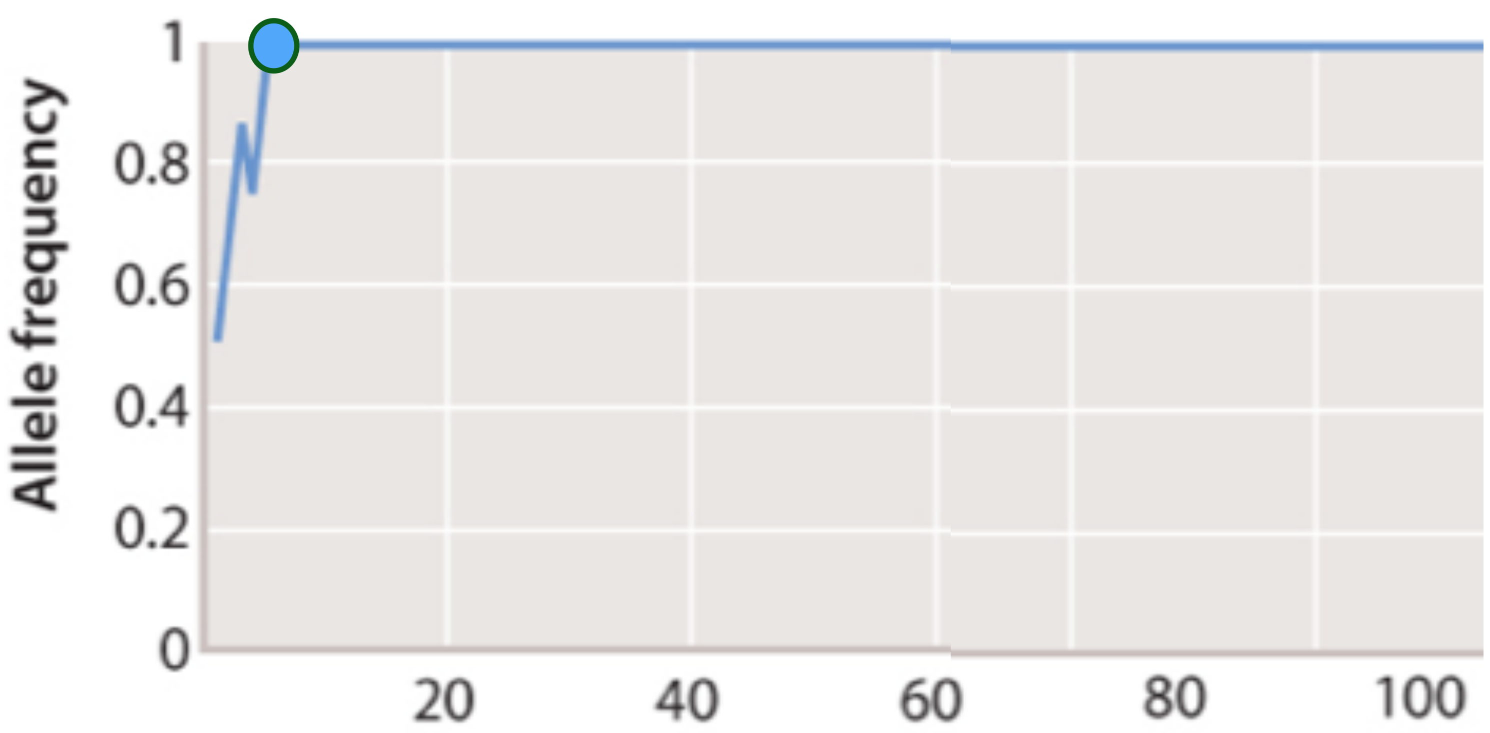

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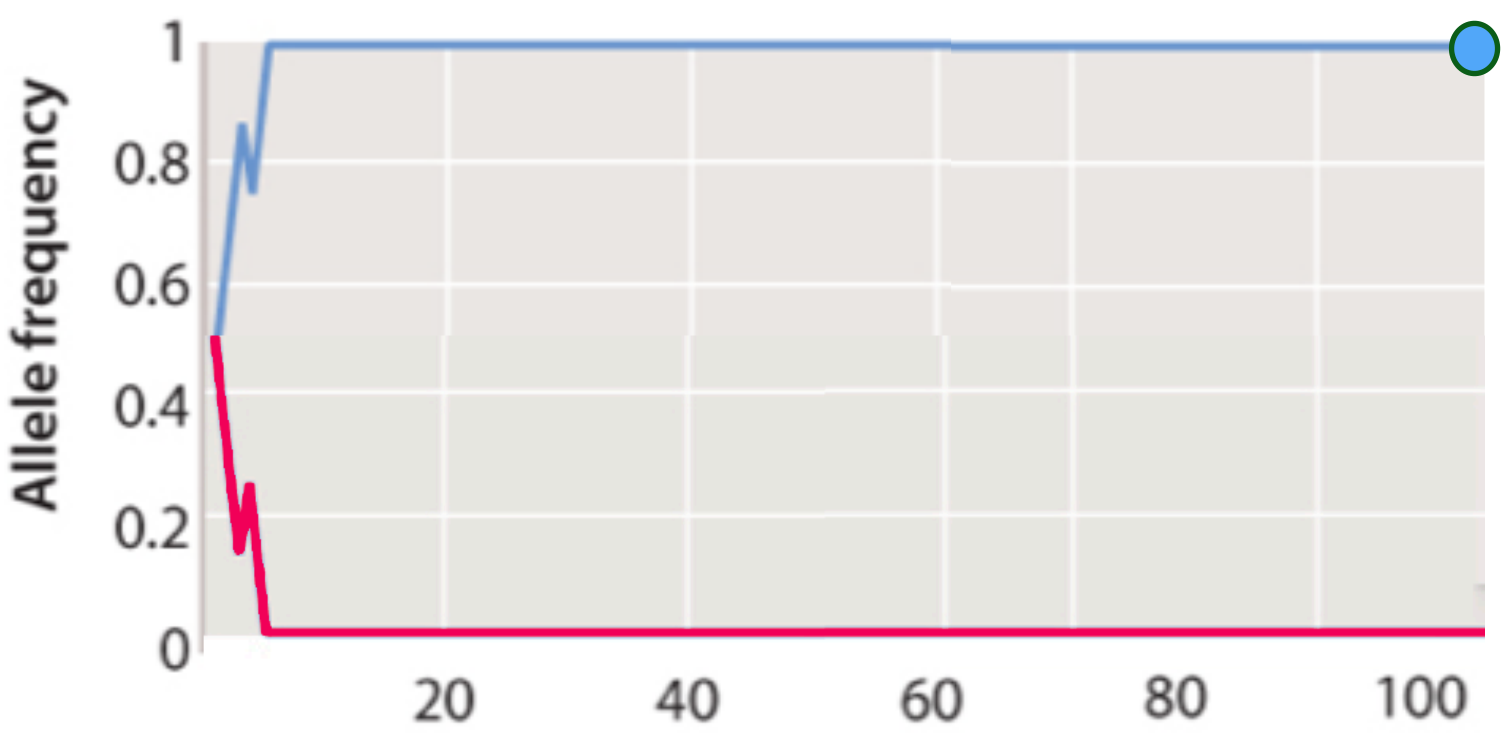
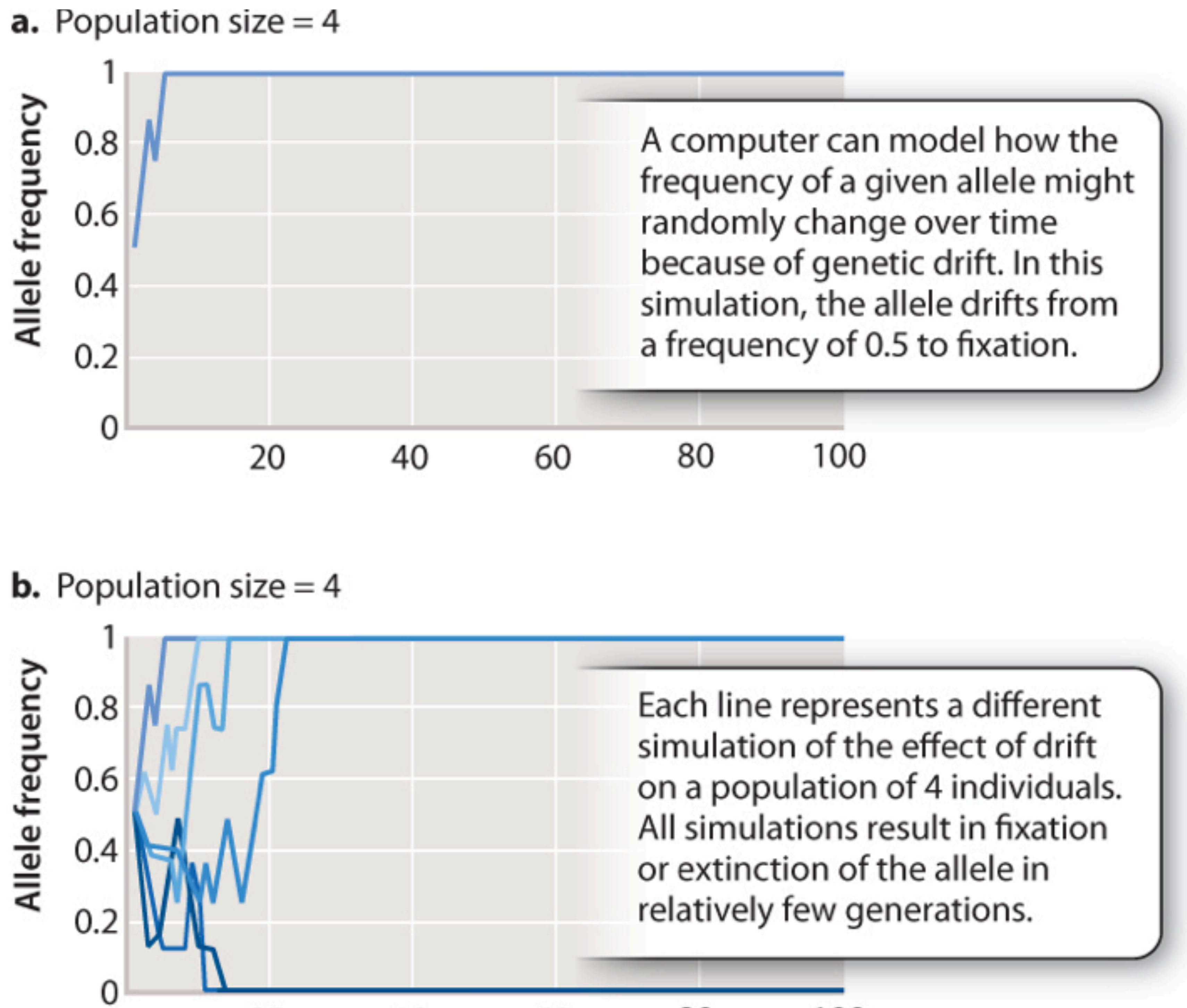
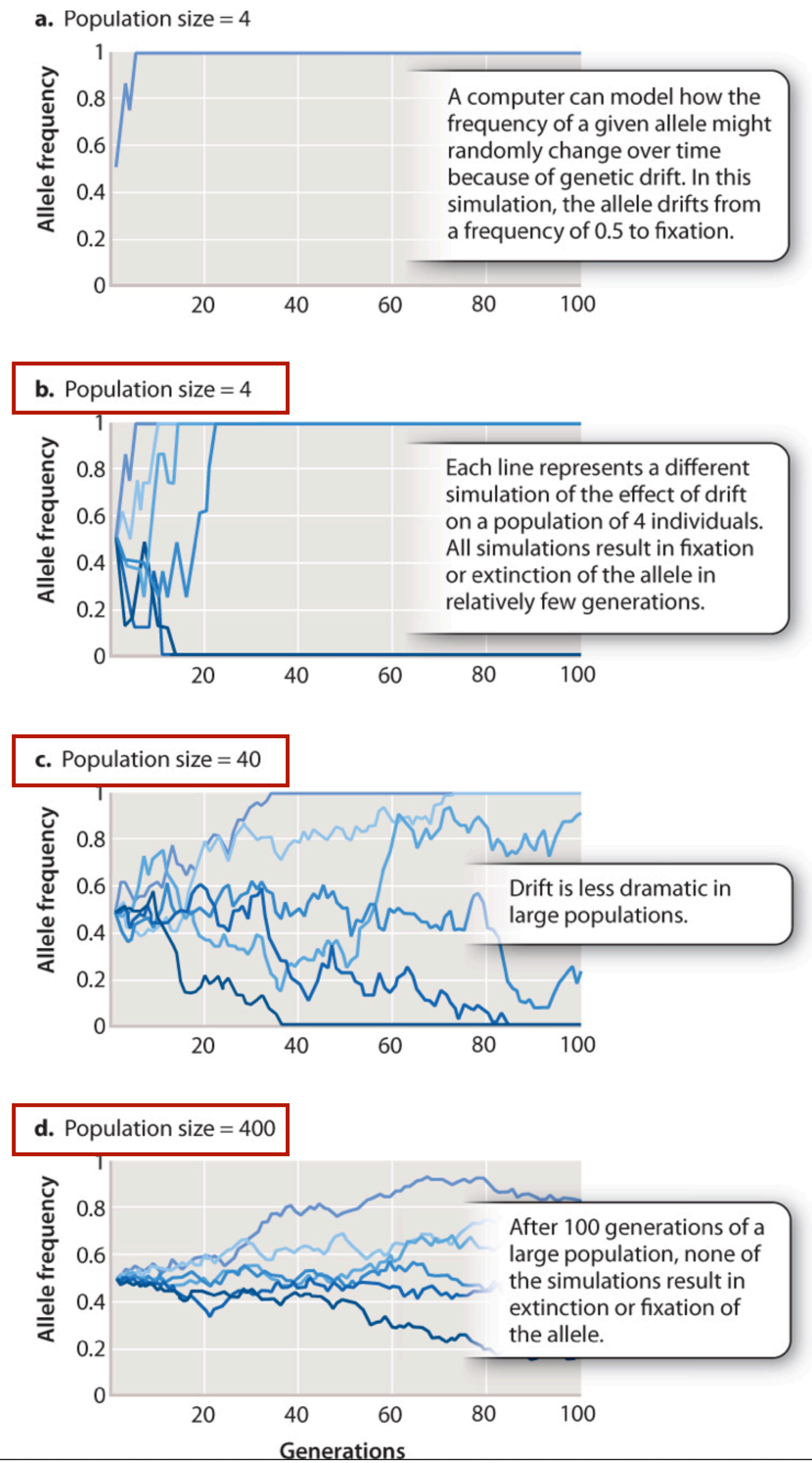



a. Population size = 4
Allele frequency
1
0.8
0.6
0.4
0.2
0
20
40
60
80
100
A computer can model how the frequency of a given allele might randomly change over time because of genetic drift. In this simulation, the allele drifts from a frequency of 0.5 to fixation.
b. Population size = 4
Allele frequency
1
0.8
0.6
0.4
0.2
0
Each line represents a different simulation of the effect of drift on a population of 4 individuals. All simulations result in fixation or extinction of the allele in relatively few generations.

Genetic Drift

Allele frequencies are subject to genetic drift, caused by sampling error from generation to generation.


a. Population size = 4
Allele frequency
A computer can model how the frequency of a given allele might randomly change over time because of genetic drift. In this simulation, the allele drifts from a frequency of 0.5 to fixation.
b. Population size = 4
Each line represents a different simulation of the effect of drift on a population of 4 individuals. All simulations result in fixation or extinction of the allele in relatively few generations.
c. Population size = 40
Drift is less dramatic in large populations.
d. Population size = 400
After 100 generations of a large population, none of the simulations result in extinction or fixation of the allele.
Generations

From an understanding of these few fundamental concepts we can build a greater understanding of more complex evolutionary terms, such as-

Genetic Drift: a random change in **allelic frequency** over time
-appreciate this as being a key mechanism of evolutionary change.

This would suggest that **Genetic Drift** might be **greatest** in **small populations** (?)

Why would that be (?) -the fewer individuals in the population, the more likely it is that random fluctuations will completely disrupt the **allelic frequency.**

In the short term (i.e over a few generations), one might expect **allelic frequencies** to increase and decrease in a random, unpredictable way, as a result of **Genetic Drift** .

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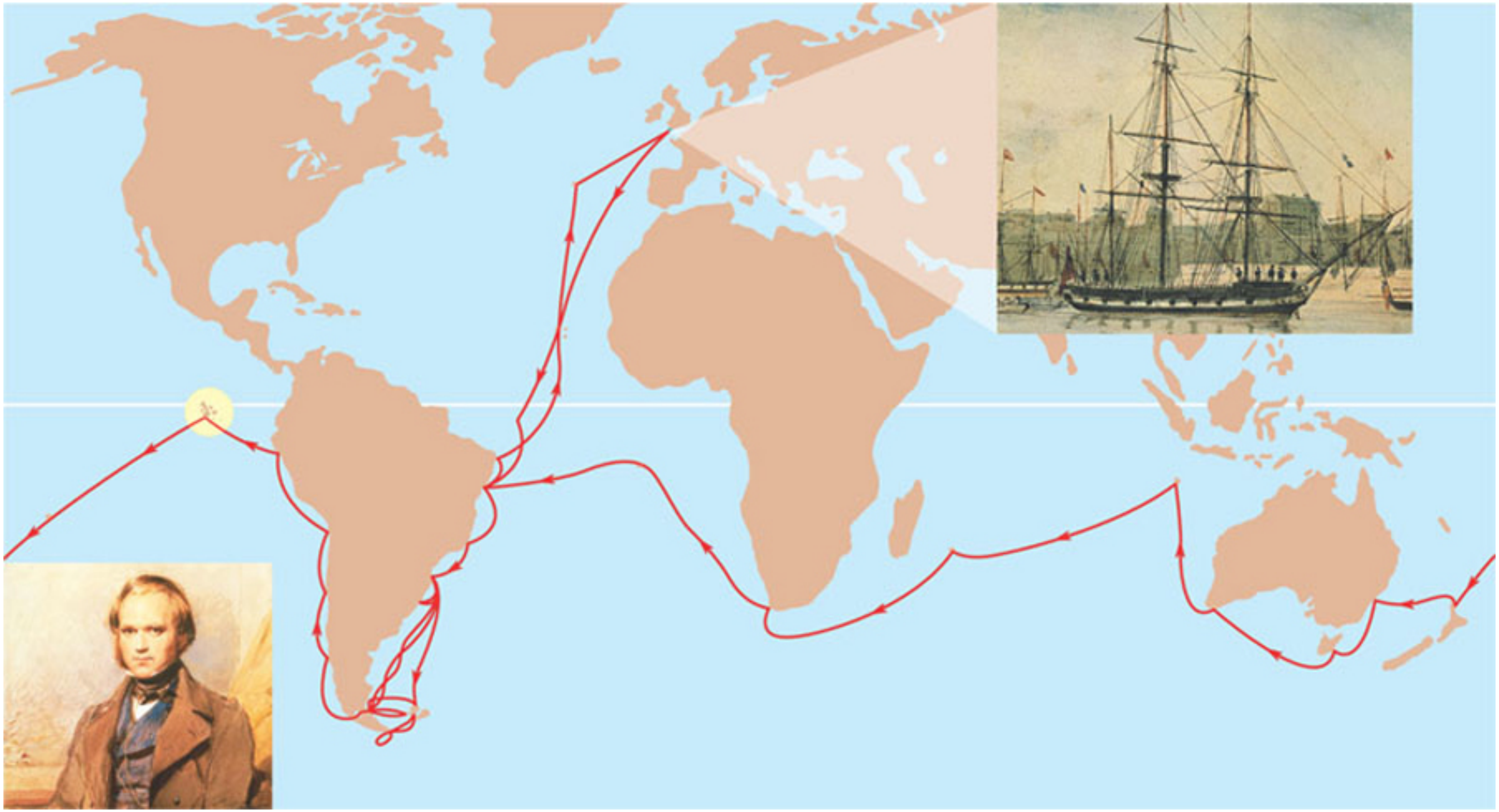
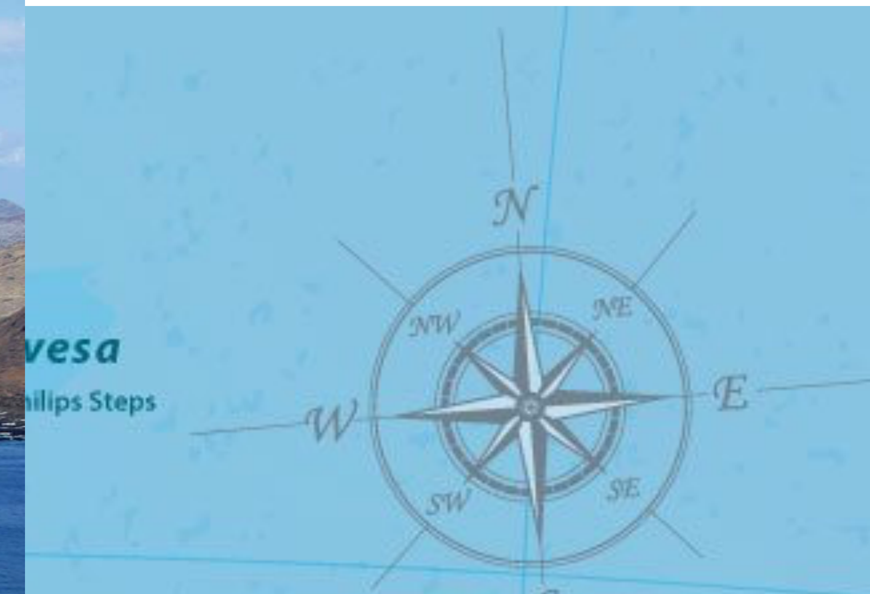


December 1831 - October 1836


N
NE
E
SE
SW
W
NW


Pinzon
Los Gemelos
Moreno Point
Sierra Negra
Puerto Ayora
Los Hermanos
Isabela
Cerro Azul
Puerto Villamil
Tortuga
Post Office Bay
Cormorant
FLoreana

Darwin
Wolf
Pinta
Marchena
Genovesa
Darwin Bay
Prince Philips Steps
archipielago de colon
EQUATOR
Albermarle Point
Wolf Volcano
Punta Vicente Roca
Darwin Volcano
Punta Espinosa
Targus Cave
Fernandina
Urbina Bay
Alcedo Volcano
Elizabeth Bay
Moreno Point
Sierra Negra
Isabela
Cerro Azul
Puerto Villamil
Tortuga
Santiago
Buccaneer Cove
Espumilla Beach
Puerto Egas
Sullivan Bay
Bartolome
Sombrero Chino
Rabida
North Seymour
Daphne Major
Black Turtle Bay
Baltra
Bachas Beach
Dragon Hill
Highlands of Santa Cruz
North Plaza
South Plaza
Whale Bay
Pinzon
Los Gemelos
Santa Cruz
Charles Darwin Research Centre
Puerto Ayora
Los Hermanos
Santa Fe
San Cristobal
Leon Dormido
Punta Pitt
Cerro Brucho
Isla Lobos
Cerro Tijeratas
El Junco Lagoon
Playa De Oro
Post Office Bay
Cormorant Point
FLoreana
Punta Suarez
Gardner Bay
Espanola
0
60 mi
Tumaco
Valdéz (Limones)
COLOMBIA
Pasto
San Lorenzo
Esmaraldas
Ipiales
Tulcán
Puerto Asís
Ibarra
Concepción
La Tagua
Nueva Loja (Lago Agrio)
Santo Domingo de los Colorados
QUITO
ECUADOR
Manta
Quevedo
Portoviejo
Ambato
Guaranda
Puyo
Riobamba
Babahoyo
Salinas
Guayaquil
Macas
Azogues
Cuenca
Machala
Tumbes
Loja
Zamora
PERU
Talara
Sullana

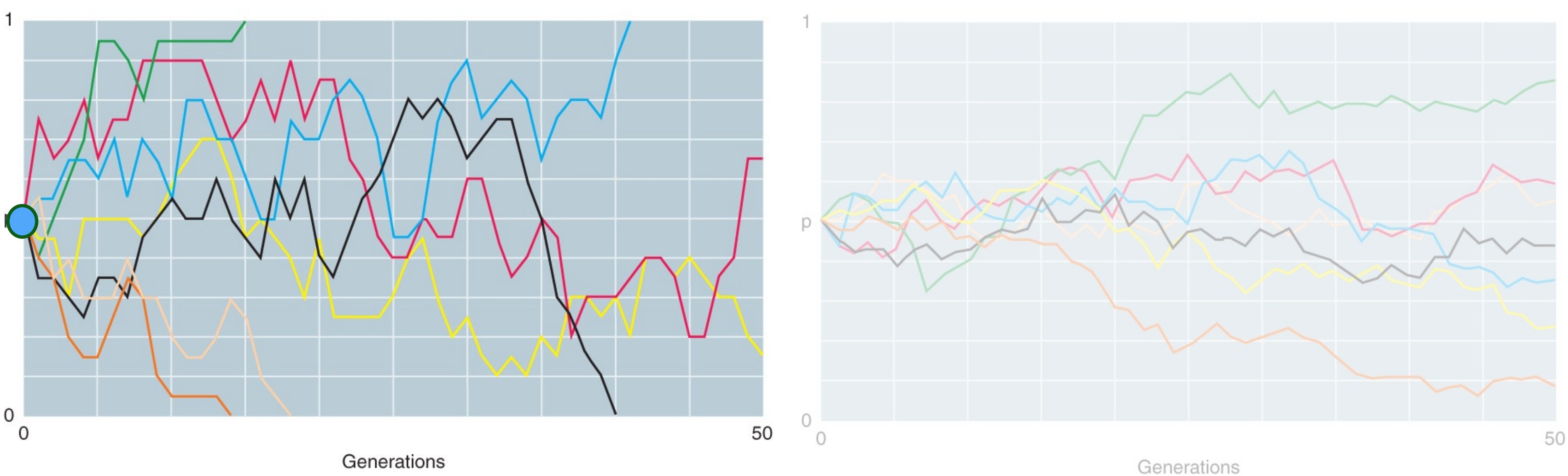
Genetic drift: a random change in **allelic frequency** over time and appreciate this as being a key mechanism of evolutionary change.

Natural Selection: ”the gradual process by which heritable biological traits become either more or less common in a **population** as a function of the effect of inherited traits on the differential reproductive success of organisms interacting with their environment"

- The frequency of a **neutral mutation** largely depends on genetic drift, the strength of which depends on the size of the population.

- The frequency of a mutation that affects phenotype will be influenced by **natural** selection.

The fixation or loss of alleles by random genetic drift occurs more rapidly in (A) populations of 10 than in (B) populations of 100



Data courtesy of Kent E. Holsinger, University of Connecticut
[http://darwin.eeb.uconn.edu]

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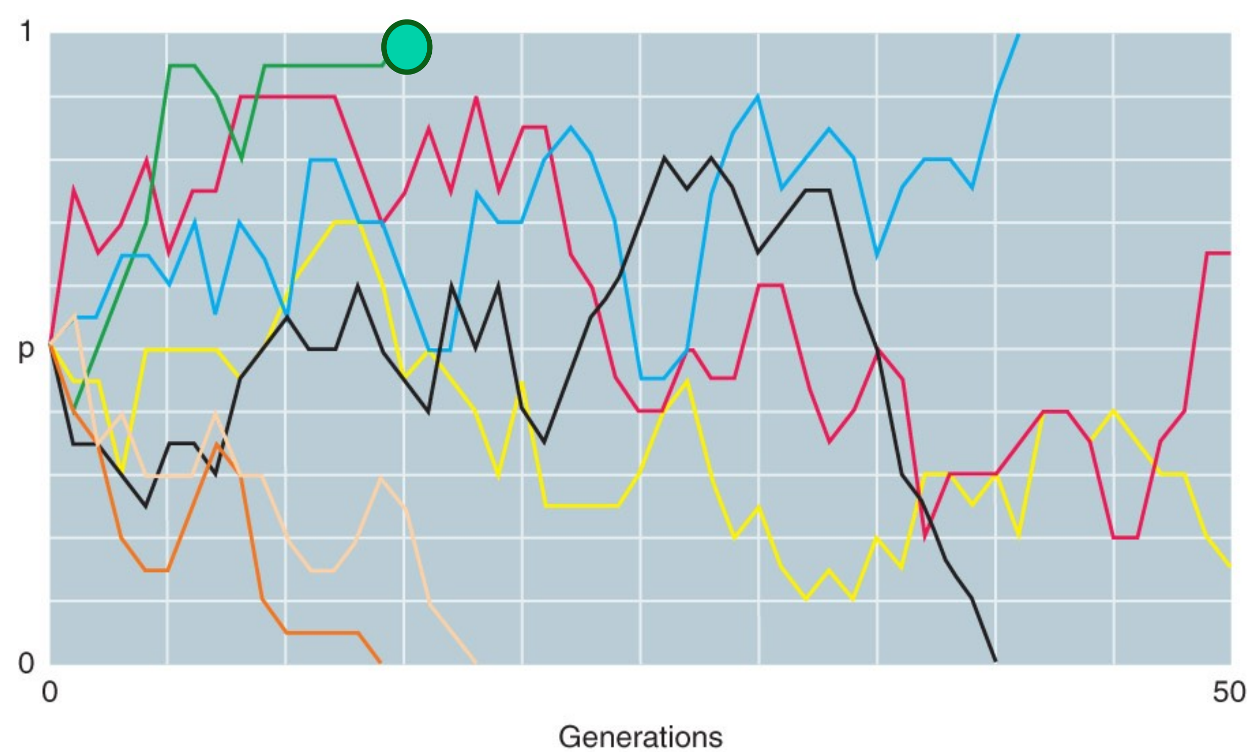

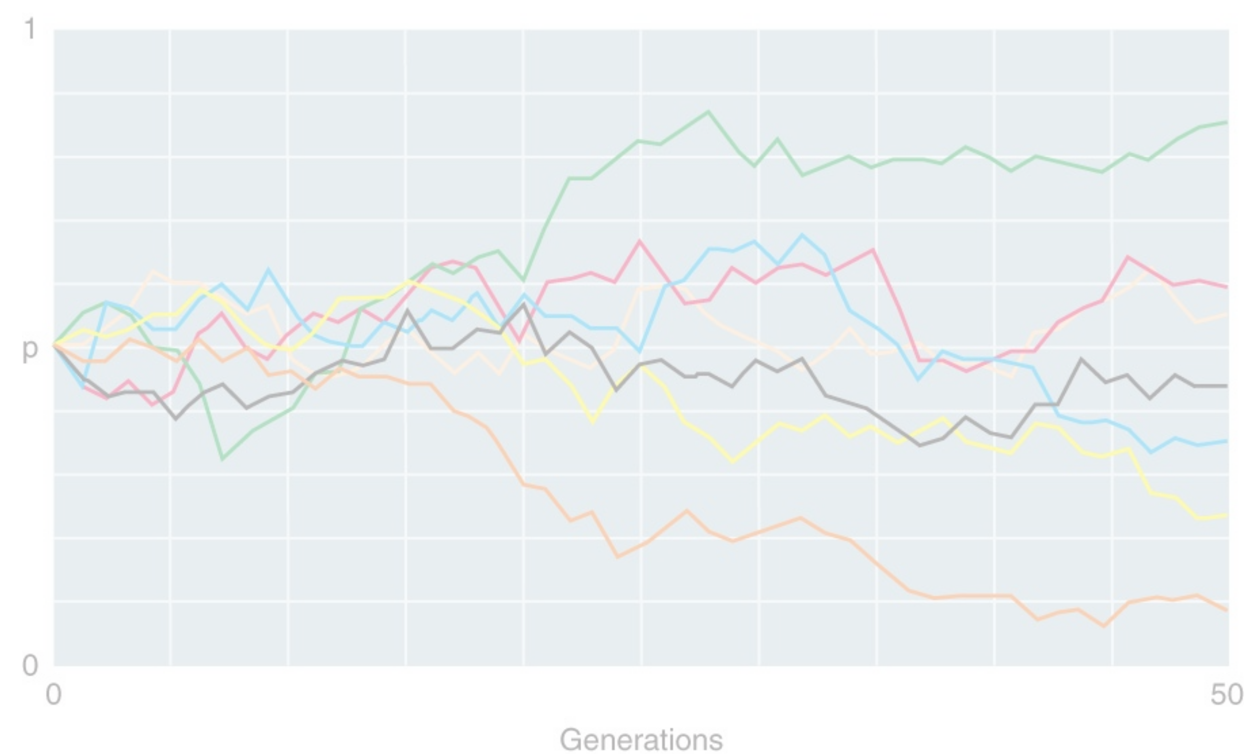

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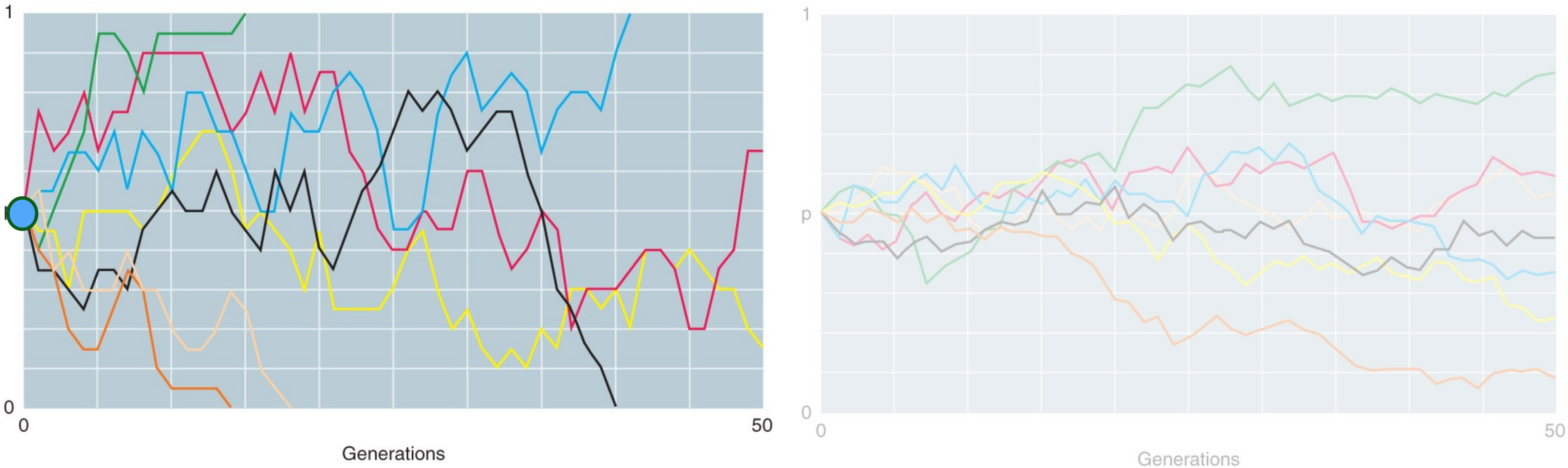

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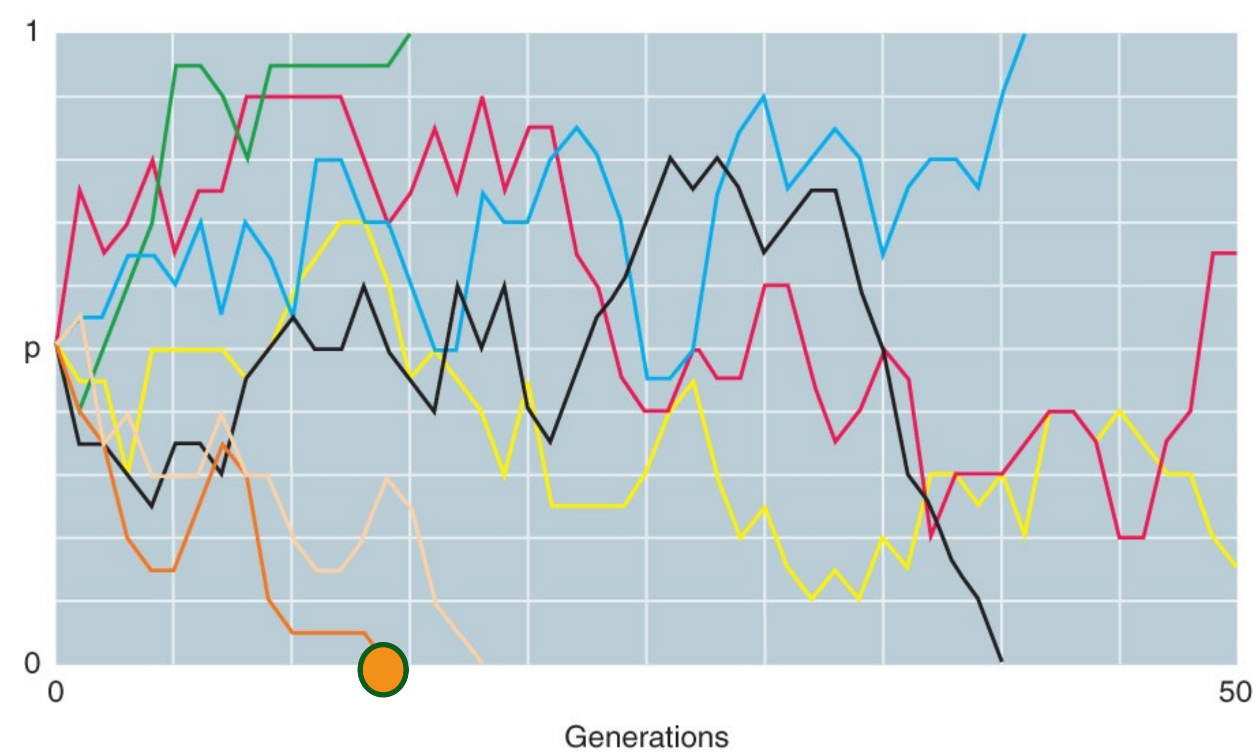

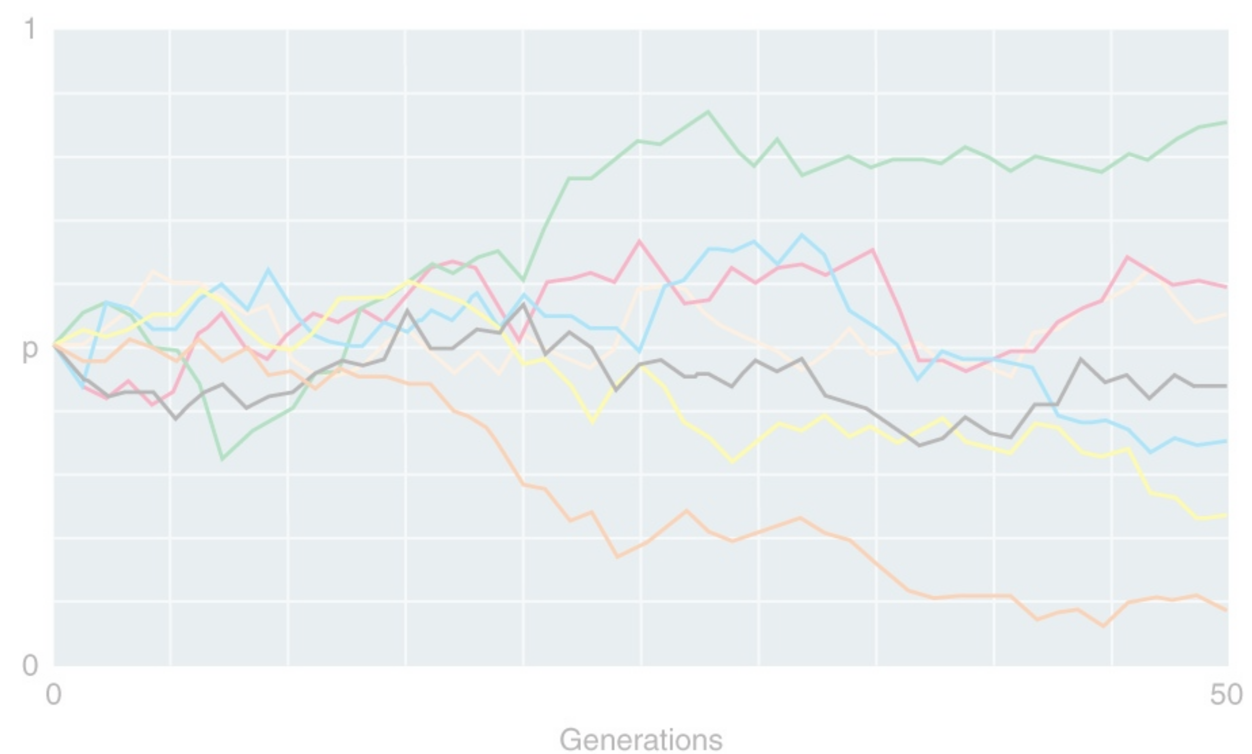

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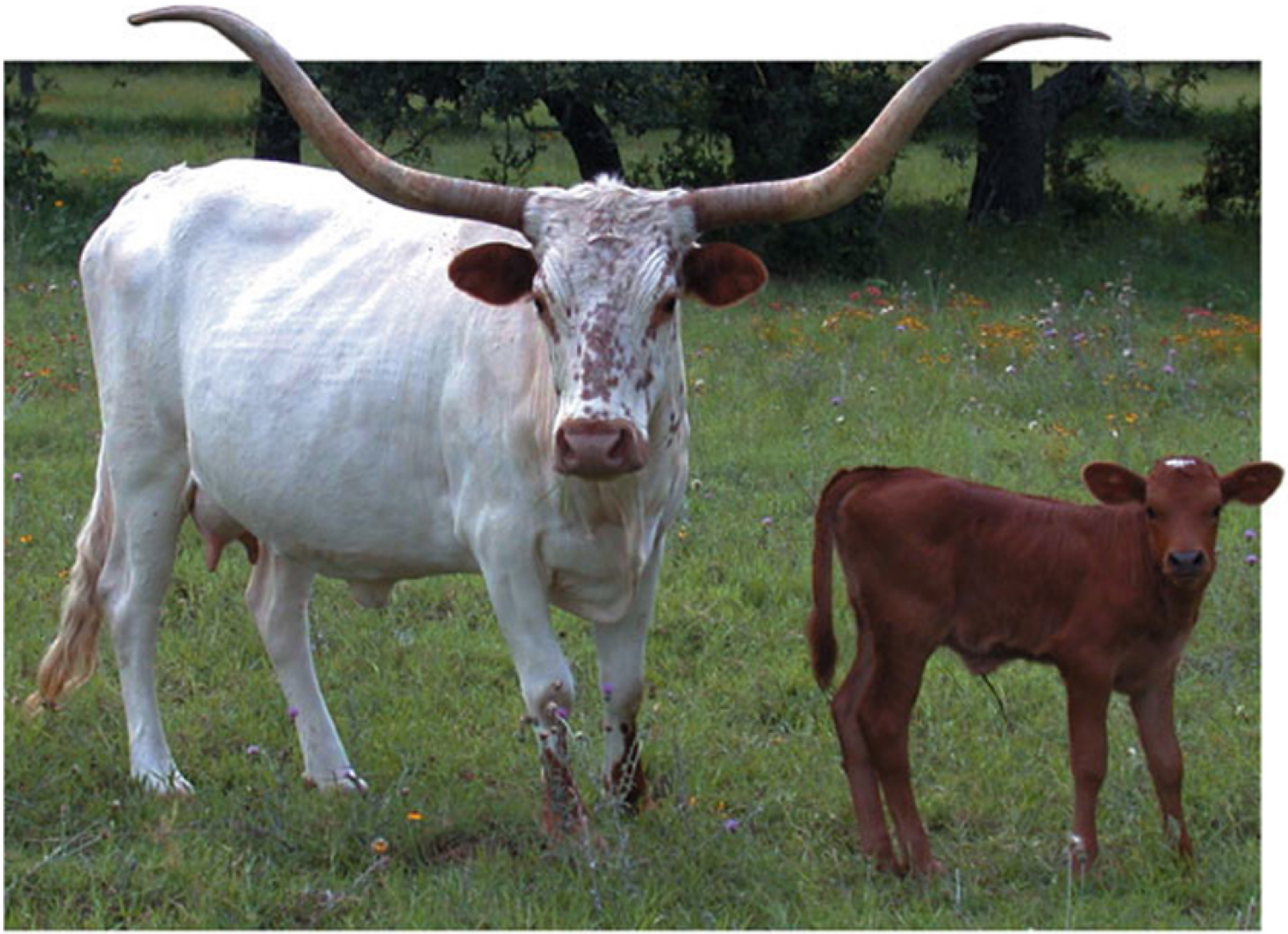


LIFE 9e, **Figure 21.14**

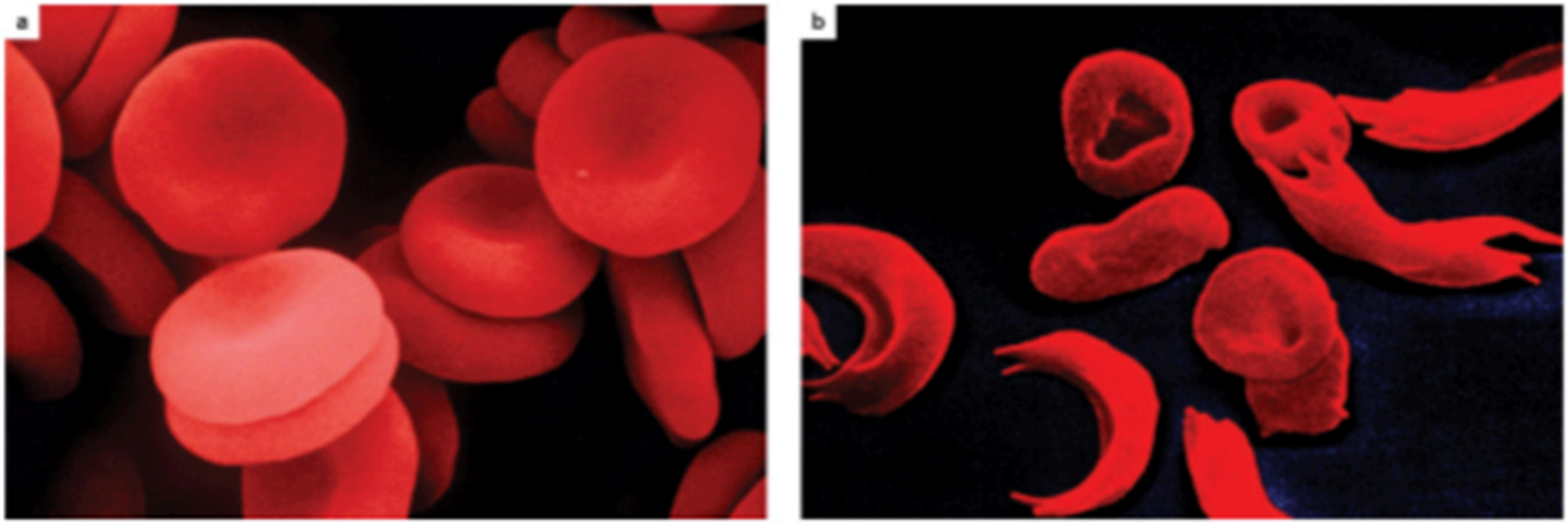
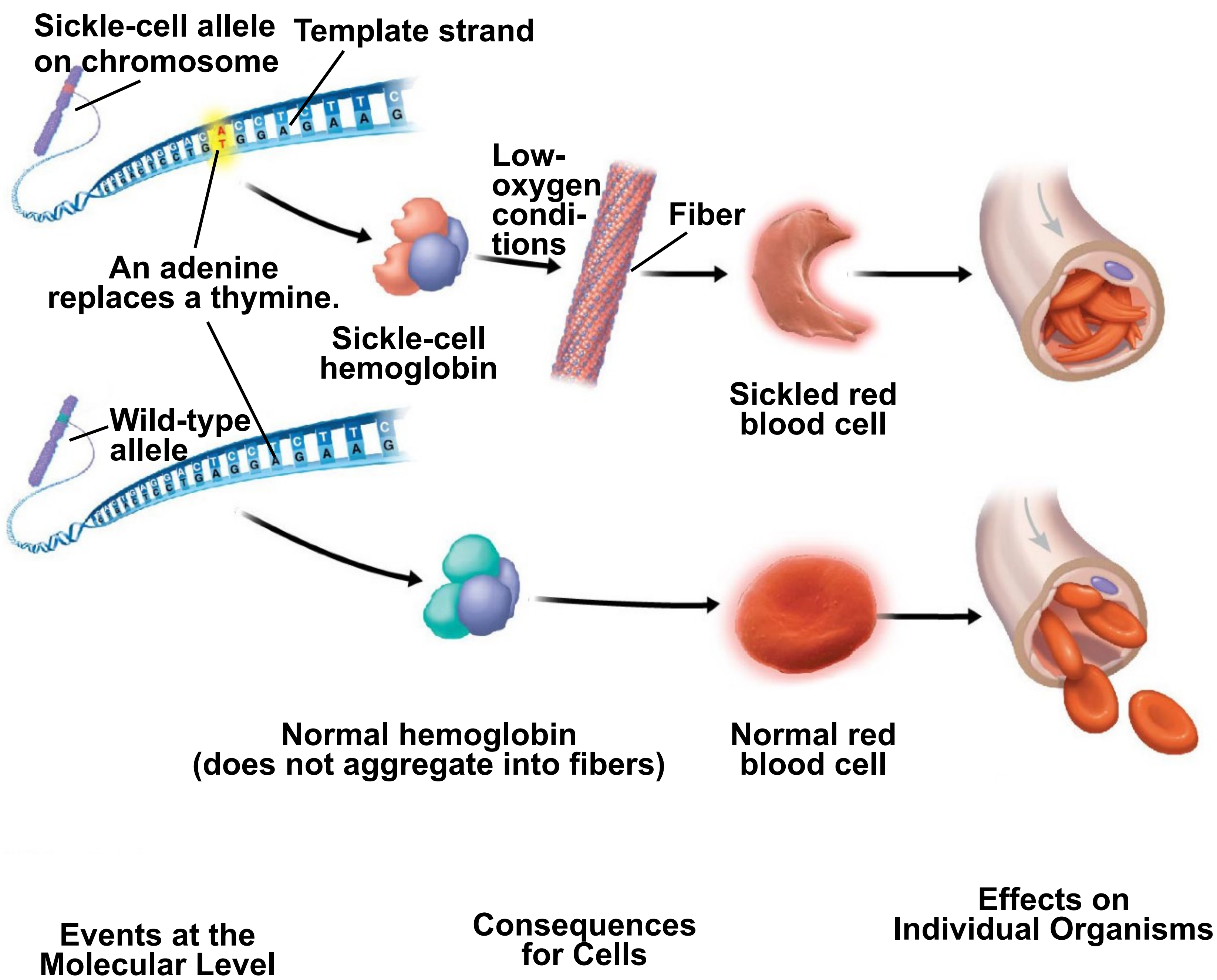


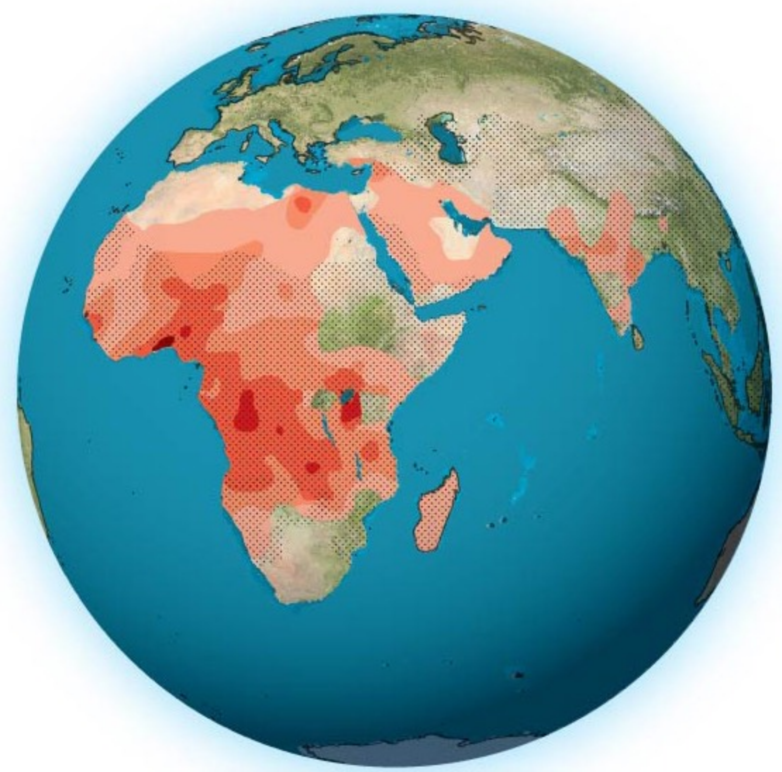
Figure 21.8: The effect of a single base-pair mutation. (a) Normal red blood cells look different from (b) sickled ones, whose shape has been distorted by hemoglobin molecules with the sickle variant.

Figure 21.15-1

Make Connections: The Sickle-Cell Allele



Evolution in Populations

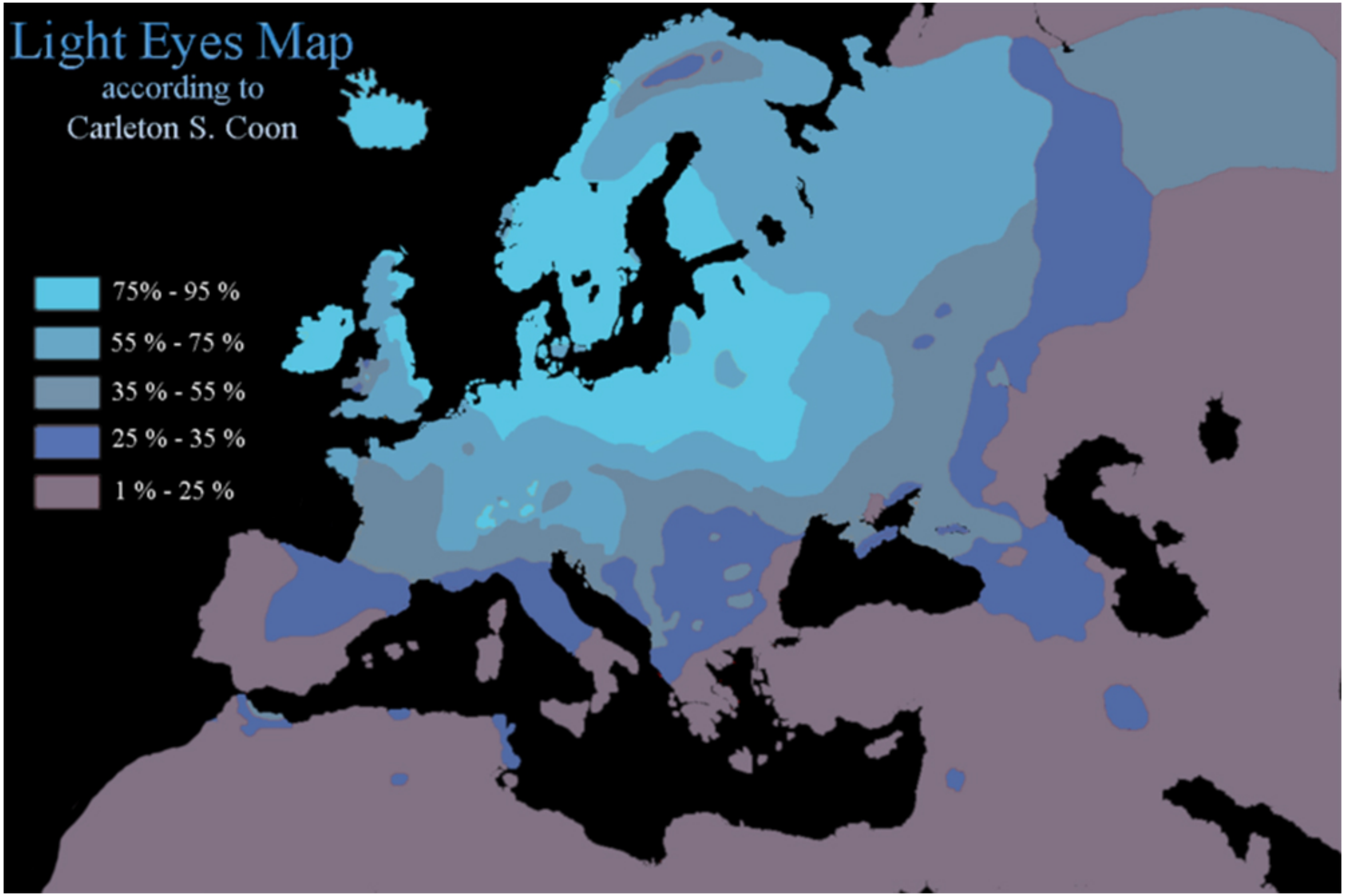


Heterozygote advantage in regions where malaria is common

Frequencies of the sickle-cell allele

- **3.0–6.0%**
- **6.0–9.0%**
- **9.0–12.0%**
- **12.0–15.0%**
- **>15.0%**

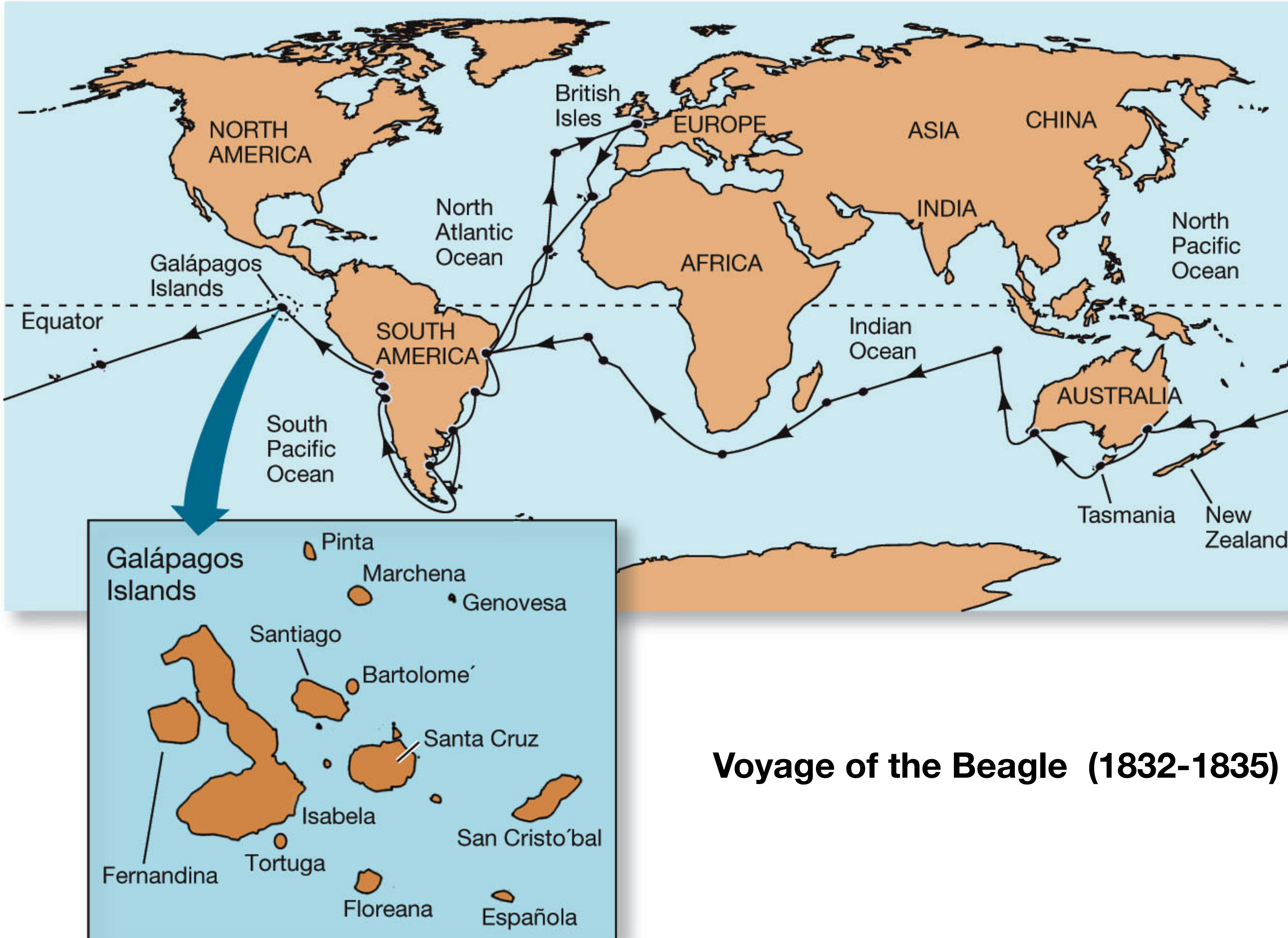
Distribution of malaria caused by *Plasmodium falciparum* (a parasitic unicellular eukaryote)



Brown Eyes: 45 percent Blue Eyes: 27 percent Hazel Eyes: 18 percent

& Green Eyes: 9 percent

Eye Colour is heavily influenced by geography and natural selection…



Voyage of the Beagle (1832-1835)

Genetic drift: a random change in **allelic frequency** over time and appreciate this as being a key mechanism of evolutionary change.

Natural Selection: ”the gradual process by which heritable biological traits become either more or less common in a **population** as a function of the effect of inherited traits on the differential reproductive success of organisms interacting with their environment"

Gene flow is the intermingling of separate traits among similar populations. This increase occurs because individuals from other populations will bring in **alleles** that would otherwise be absent or rare (may be even lost) from the population that is being observed. In other words they would add **variety** to the **gene pool**.

TABLE 21.2

Earth's Geological History *(Part 2)*

RELATIVE TIME SPAN	ERA	PERIOD	ONSET	MAJOR EVENTS IN THE HISTORY OF LIFE
	Cenozoic	Quaternary	1.8 mya	Humans evolve; many large mammals become extinct
		Tertiary	65 mya	Diversification of birds, mammals, flowering plants, and insects
	Mesozoic	Cretaceous	145 mya	Dinosaurs continue to diversify; flowering plants and mammals diversify; mass extinction at end of period (≈76% of species disappear)
		Jurassic	200 mya	Diverse dinosaurs; radiation of ray-finned fishes
		Triassic	251 mya	Early dinosaurs; first mammals; marine invertebrates diversify; first flowering plants; mass extinction at end of period (≈65% of species disappear)
	Paleozoic	Permian	297 mya	Reptiles diversify; amphibians decline; mass extinction at end of period (≈96% of species disappear)
		Carboniferous	359 mya	Extensive "fern" forests; first reptiles; insects diversify
		Devonian	416 mya	Fishes diversify; first insects and amphibians; mass extinction at end of period (≈75% of species disappear)
		Silurian	444 mya	Jawless fishes diversify; first ray-finned fishes; plants and animals colonize land
		Ordovician	488 mya	Mass extinction at end of period (≈75% of species disappear)
		Cambrian	542 mya	Most animal phyla present; diverse photosynthetic protists
Precambrian	Precambrian		600 mya	Ediacaran fauna
			1.5 bya	Eukaryotes evolve; several animal phyla appear
			3.8 bya	Origin of life; prokaryotes flourish
			4.5 bya	

[a]mya, million years ago; bya, billion years ago.

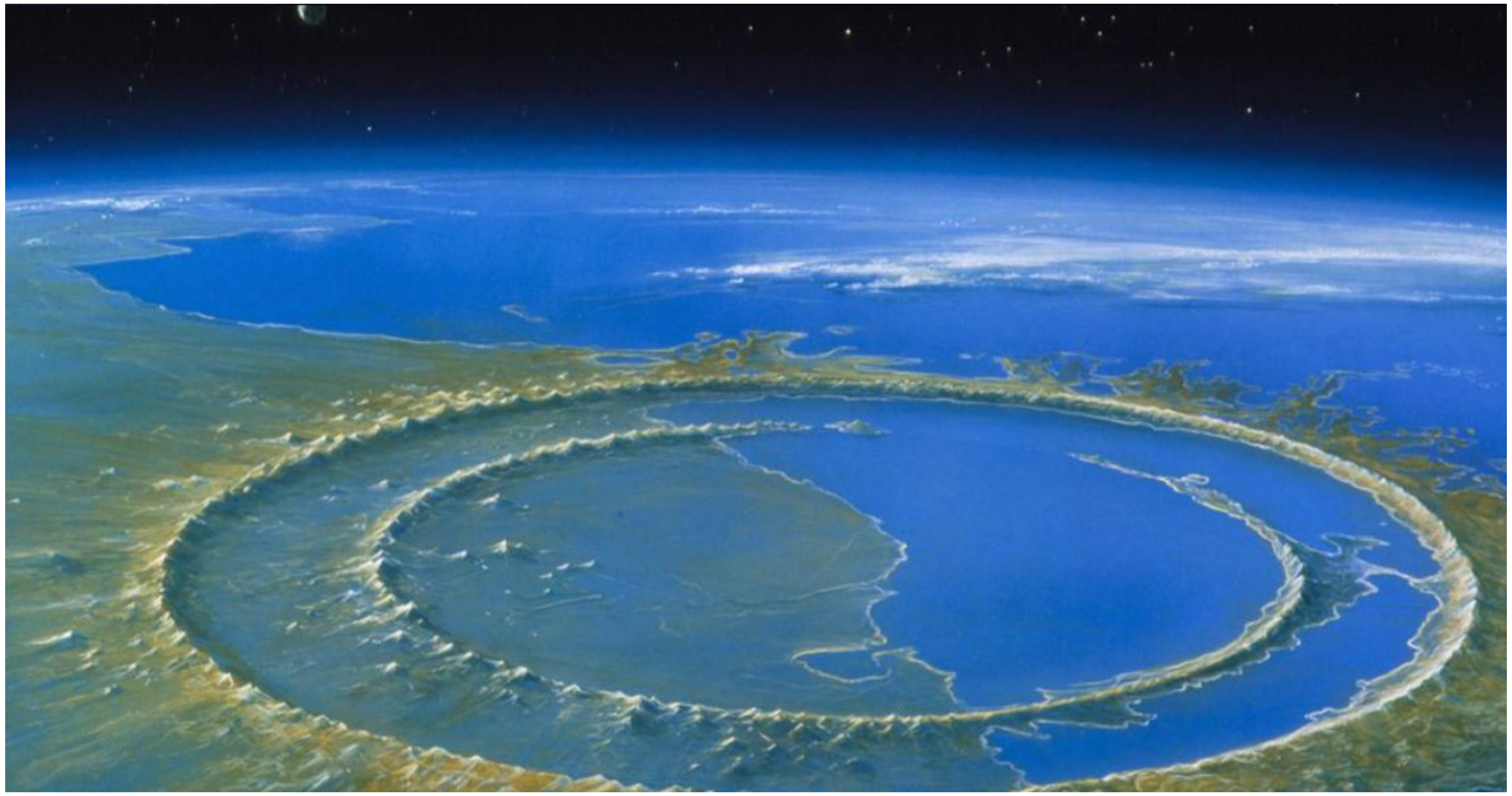
***LIFE 8e*, Table 21.2 (Part 2)**

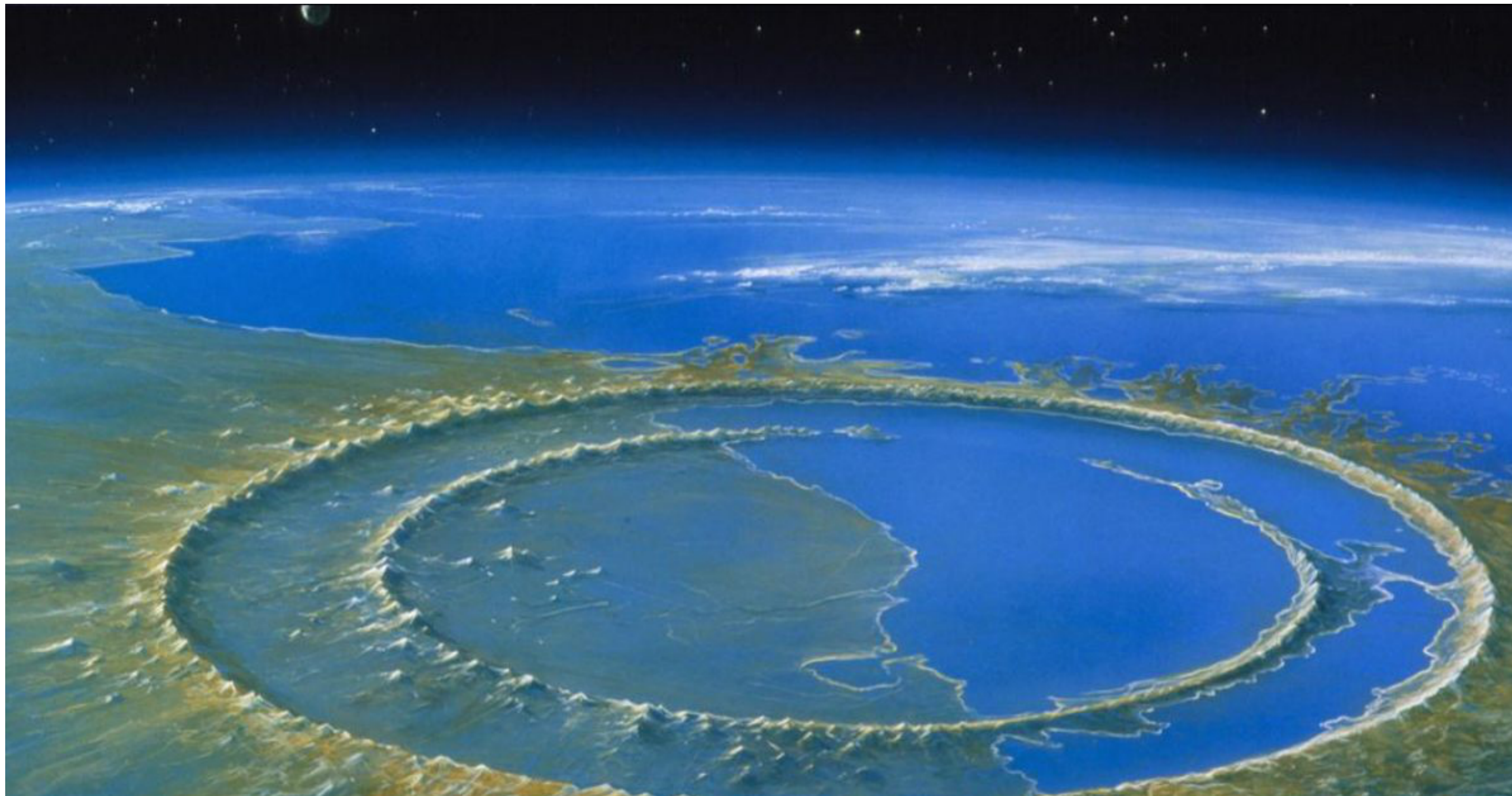
The **Cretaceous–Paleogene** (**K–Pg**) **extinction event**

Also known as the **Cretaceous–Tertiary** (**K–T**) **extinction**)[b] was a sudden mass extinction of three-quarters of the plant and animal species on Earth,[2][3][4] approximately **66 million years ago.**[3] With the exception of some ectothermic species such as sea turtles and crocodilians, no tetrapods weighing more than 25 kilograms (55 pounds) survived.[5] It marked the end of the Cretaceous Period, and with it the Mesozoic era, while heralding the beginning of the Cenozoic era, which continues to this day.

In the geologic record, the K–Pg event is marked by a thin layer of sediment called the K–Pg boundary, which can be found throughout the world in marine and terrestrial rocks.

The boundary clay shows unusually high levels of the metal iridium, which is more common in asteroids than in the Earth's crust.[6]






Buried
crater
Gulf of Mexico
Mexico

The **Cretaceous–Paleogene** (**K–Pg**) **extinction event**

Also known as the **Cretaceous–Tertiary** (**K–T**) **extinction**)[b] was a sudden mass extinction of three-quarters of the plant and animal species on Earth,[2][3][4] approximately **66 million years ago.**[3] With the exception of some ectothermic species such as sea turtles and crocodilians, no tetrapods weighing more than 25 kilograms (55 pounds) survived.[5] It marked the end of the Cretaceous Period, and with it the Mesozoic era, while heralding the beginning of the Cenozoic era, which continues to this day.

In the geologic record, the K–Pg event is marked by a thin layer of sediment called the K–Pg boundary, which can be found throughout the world in marine and terrestrial rocks.

The boundary clay shows unusually high levels of the metal iridium, which is more common in asteroids than in the Earth's crust.[6]

The **Deccan Traps** began forming **66.25 million years ago**,[5] at the end of the Cretaceous period, although it is possible that some of the oldest material may underlie younger material.[2][6]

The bulk of the volcanic eruption occurred at the Western Ghats between 65 and 66 million years ago when lava began to extrude through fissures in the crust known as fissure eruptions.[8]

WIKIPEDIA
The Free Encyclopedia

Bottlenecks

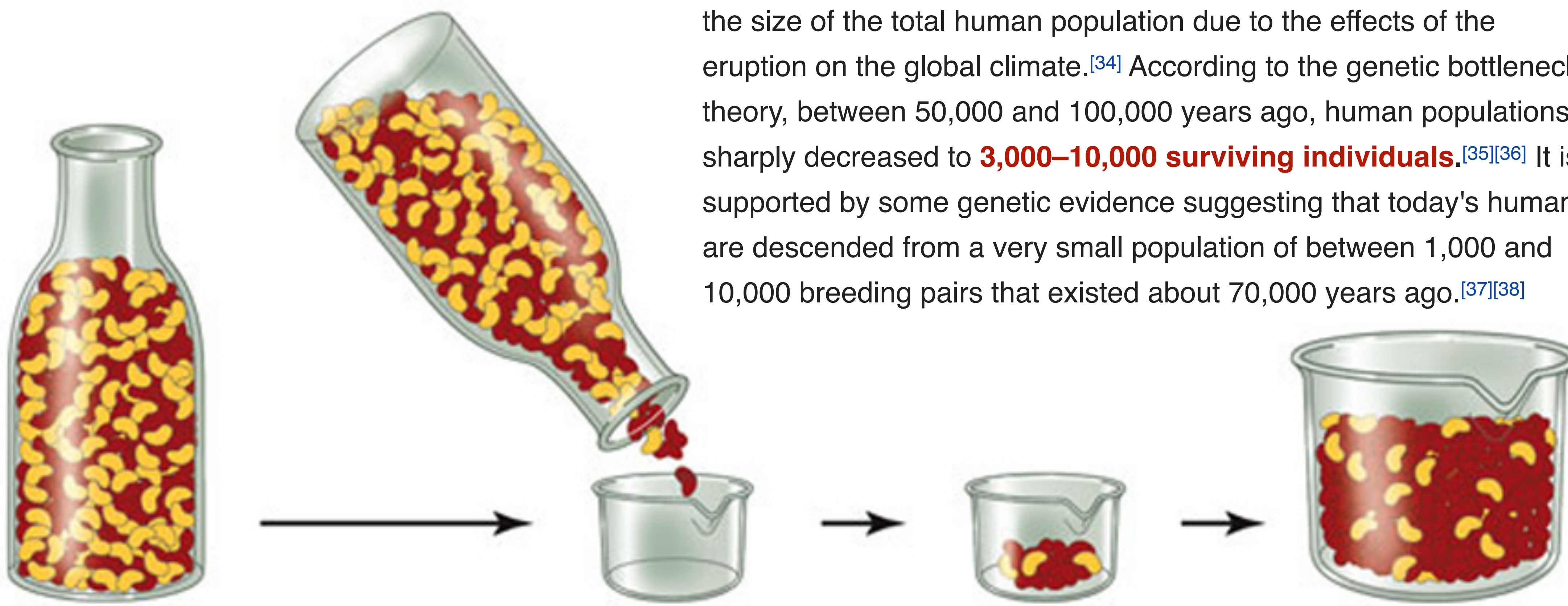
Toba catastrophe theory

From Wikipedia, the free encyclopedia

The **Toba supereruption** was a supervolcanic eruption that occurred about 75,000 years ago at the site of present-day Lake Toba in Sumatra, Indonesia. It is one of the Earth's largest known eruptions. The **Toba catastrophe theory** holds that this event caused a global volcanic winter of six to ten years and possibly a 1,000-year-long cooling episode.

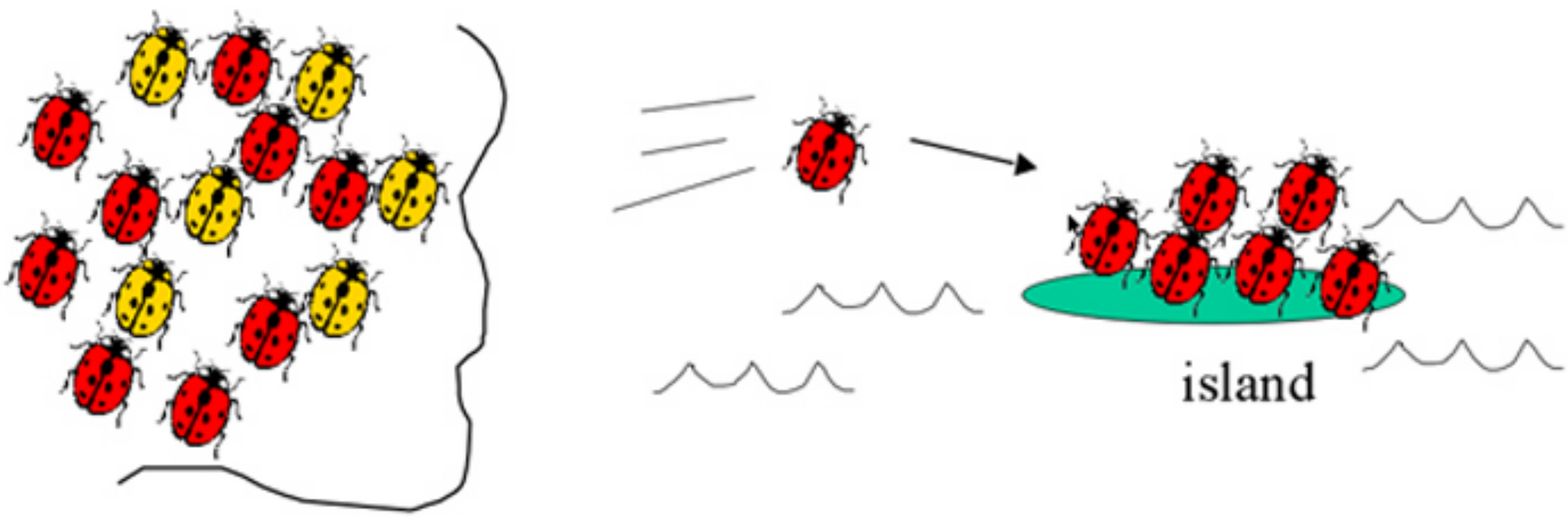
In 1993, science journalist Ann Gibbons posited that a population bottleneck occurred in human evolution about 70,000 years ago, and she suggested that this was caused by the eruption. Geologist Michael R. Rampino of New York University and volcanologist Stephen Self of the University of Hawaii at Manoa support her suggestion. In 1998, the bottleneck theory was further developed by anthropologist Stanley H. Ambrose of the University of Illinois at Urbana–Champaign. Both the link and global winter theories are highly controversial.[1] The Toba event is the most closely studied supereruption.[2][3]

It is hypothesized that the eruption resulted in a severe reduction in the size of the total human population due to the effects of the eruption on the global climate.[34] According to the genetic bottleneck theory, between 50,000 and 100,000 years ago, human populations sharply decreased to **3,000–10,000 surviving individuals.**[35][36] It is supported by some genetic evidence suggesting that today's humans are descended from a very small population of between 1,000 and 10,000 breeding pairs that existed about 70,000 years ago.[37][38]



The case of **Huntington's disease** in South Africa

The Afrikaner population of South Africa is mainly descended from one shipload of immigrants which landed in **1652.** The early colonists included individuals with a number of rare genes. The ship of 1652 contained a Dutch man carrying the gene for Huntington's disease, an autosomal dominant disease which does not appear until the sufferer is over 40 years old and leads to certain death within five to 10 years. Most cases of the disease in the modern Afrikaner population can be traced back to that individual.



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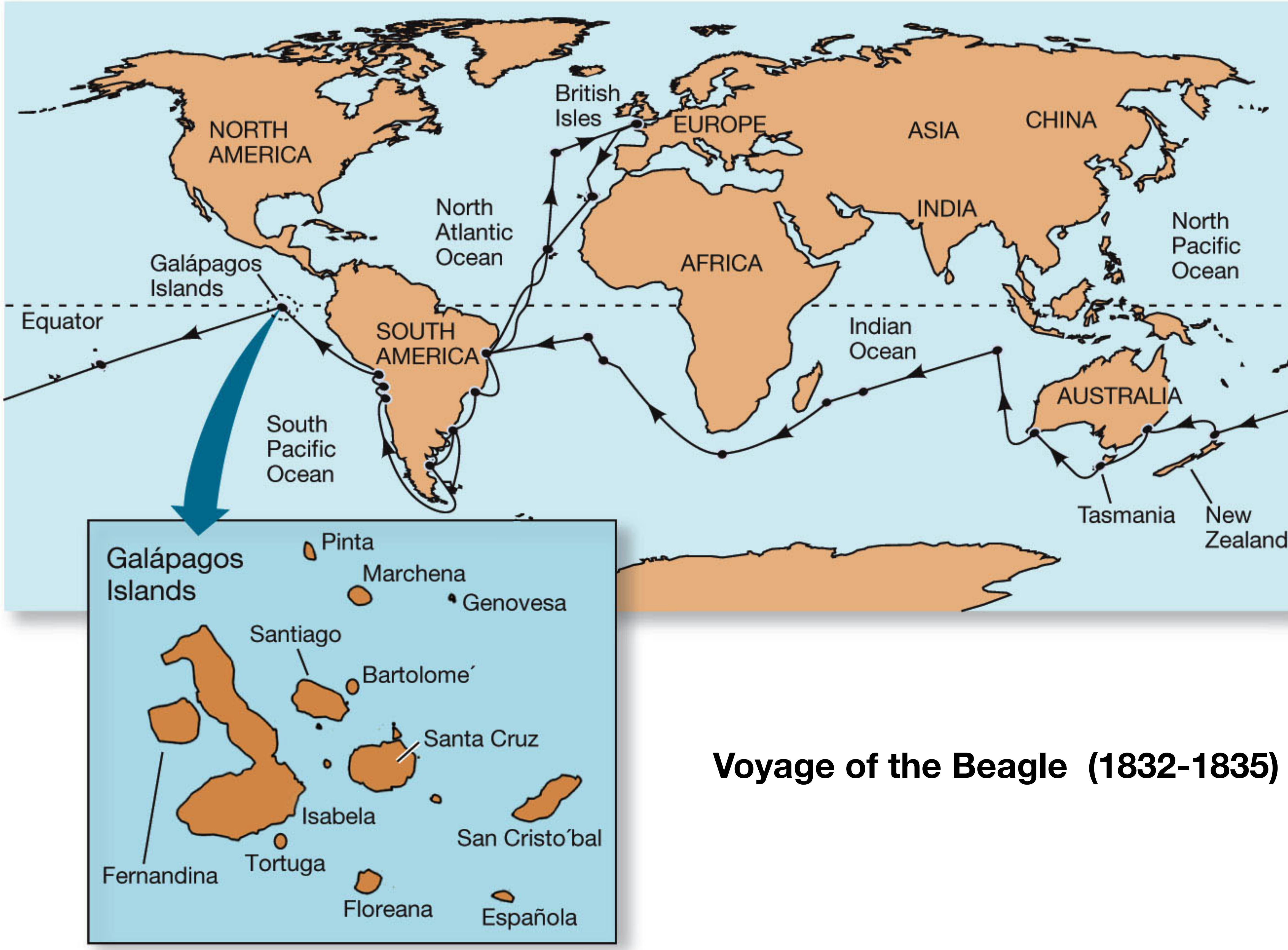


Voyage of the Beagle (1832-1835)

Genetic drift: a random change in **allelic frequency** over time and appreciate this as being a key mechanism of evolutionary change.

Natural Selection: ”the gradual process by which heritable biological traits become either more or less common in a **population** as a function of the effect of inherited traits on the differential reproductive success of organisms interacting with their environment"

Gene flow is the intermingling of separate traits among similar populations. This increase occurs because individuals from other **populations** will bring in **alleles** that would otherwise be absent or rare (may be even lost) from the population that is being observed. In other words they would add **variety** to the **gene pool**.

Given all this, might the "forces of evolution" work equally well on populations that have a limited **gene pool**, as they do in those **populations** with a much larger -effectively infinite- variety of alleles within its **gene pool**?

Yes or No?

Given all this, Are there any other constraints to evolutionary change(s)?

Answer:

Natural Selection: ”the gradual process by which heritable biological traits become either more or less common in a **population** as a function of the effect of inherited traits on the differential reproductive success of organisms interacting with their environment"

Genetic drift: a random change in **allelic frequency** over time and appreciate this as being a key mechanism of evolutionary change.

Gene flow is the intermingling of separate traits among similar populations. This increase occurs because individuals from other populations will bring in **alleles** that would otherwise be absent or rare (may be even lost) from the population that is being observed. In other words they would add **variety** to the **gene pool**.

Mutations localized changes in the DNA blueprint that may or may not change the phenotypic characteristics, ultimately providing small changes in genes /alleles -see Genetic Drift

Given all this, Are there any other constraints to evolutionary change(s)?

Answer: Yes.

How did we get such a diverse gene pool?


GALLAPAGOS ISLANDS
Discovered and Described
by Capt. Cowley in
1684.
Lord Wenman's
Island
Nories Rocks
East Bay
Bindloss Isl.
South Bay
Dassigney's Isl.

1859

ON THE ORIGIN OF SPECIES.

INTRODUCTION.

When on board H.M.S. 'Beagle,' as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species—that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions, which then seemed to me probable: from that period to the present day I have steadily pursued the same object. I hope that I may be excused for entering on these personal details, as I give them to show that I have not been hasty in coming to a decision.

My work is now nearly finished; but as it will take me two or three more years to complete it, and as my health is far from strong, I have been urged to publish this Abstract. I have more especially been induced to do this, as Mr. Wallace, who is now studying the natural history of the Malay archipelago, has arrived at almost exactly the same general conclusions that I have on the origin of species. Last year he sent to me a memoir on this subject, with a request that I would forward it to Sir Charles Lyell, who sent it to the Linnean Society, and it is published in the third volume of the Journal of that Society. Sir C. Lyell and Dr. Hooker, who both knew of my work—the latter having read my sketch of 1844—honoured me by thinking it advisable to publish, with Mr. Wallace's excellent memoir, some brief extracts from my manuscripts.

This Abstract, which I now publish, must necessarily be imperfect. I cannot here give references and authorities for my several statements; and I must trust to the reader reposing some confidence in my accuracy. No doubt errors will have crept in, though I hope I have always been cautious in trusting to good authorities alone. I can here give only the general conclusions at which I have

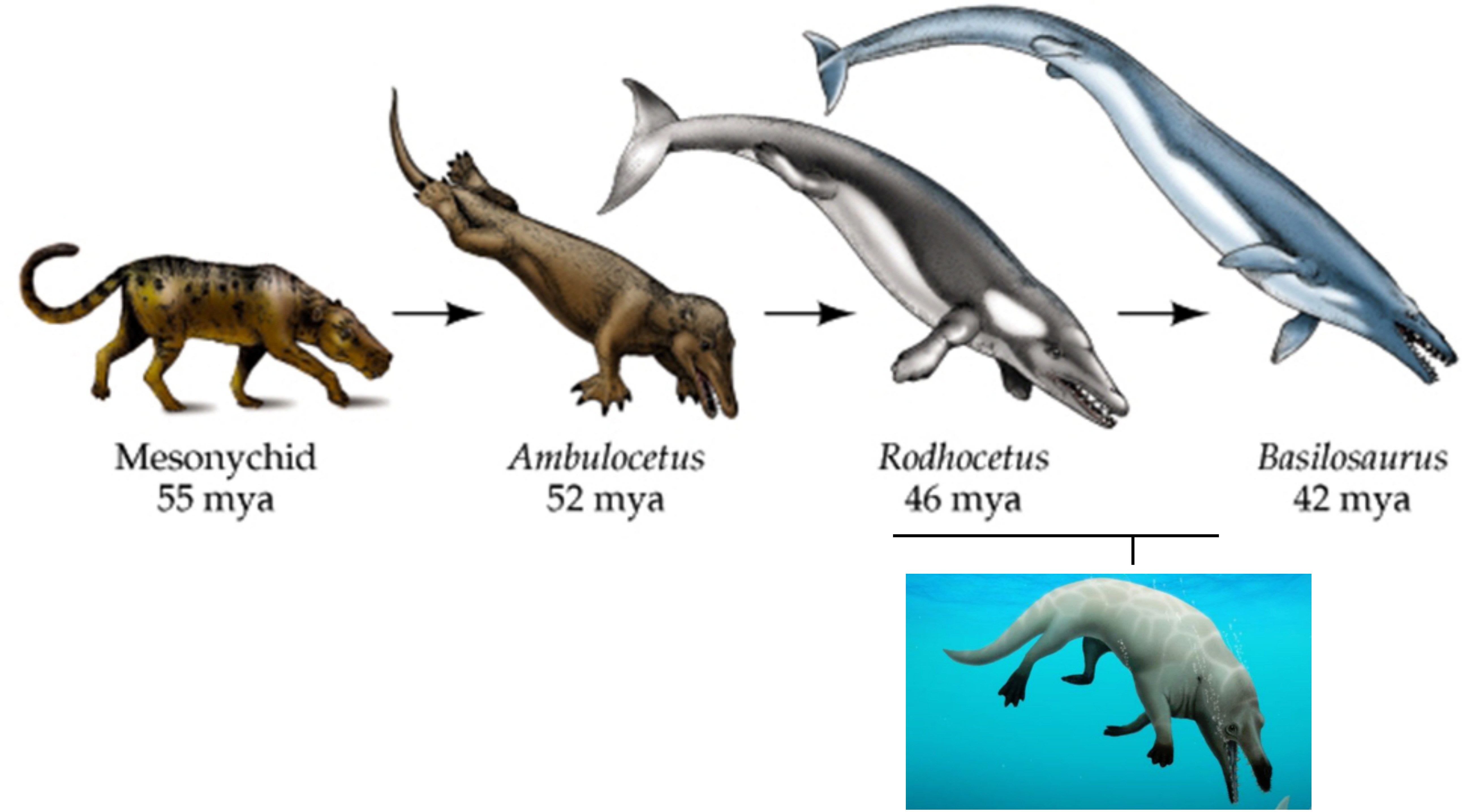
In considering the Origin of Species, it is quite conceivable that a naturalist, reflecting on the mutual affinities of organic beings, on their embryological relations, their geographical distribution, geological succession, and other such facts, might come to the conclusion **that each species had not been independently created, but had descended, like varieties, from other species.**

Nevertheless, such a conclusion, even if well founded, would be **unsatisfactory**, until it could be shown how the innumerable species inhabiting this world **have been modified, so as to acquire that perfection of structure** and coadaptation which most justly excites our admiration.

and that these had been produced perfect as we now see them; but this assumption seems to me to be no explanation, for it leaves the case of the coadaptations of organic beings to each other and to their physical conditions of life, untouched and unexplained.

It is, therefore, of the highest importance to gain a clear insight into the means of modification and coadaptation. At the commencement of my observations it seemed to me probable that a careful study of domesticated animals and of cultivated plants would offer the best chance of making out this obscure problem. Nor have I been disappointed; in this and in all other perplexing cases I have invariably found that our knowledge, imperfect though it be, of variation under domestication, afforded the best and safest clue. I may venture to express my conviction of the high value of such studies, although they have been very commonly neglected by naturalists.

From these considerations, I shall devote the first chapter of this Abstract to Variation under Domestication. We shall thus see that a large amount of hereditary modification is at least possible, and, what is equally or more important, we shall see how great is the power of man in accumulating by his Selection successive slight variations. I will then pass on to the variability of species in a state of nature; but I shall, unfortunately, be compelled to treat this subject far too briefly, as it can be treated properly only by giving long catalogues of facts. We shall, however, be enabled to discuss what circumstances are most favourable to variation. In the next chapter the Struggle for Existence amongst all organic beings throughout the world, which inevitably follows from their high geometrical powers of increase, will be treated of. This is the doctrine of Malthus, applied to the whole animal and vegetable kingdoms. As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be NATURALLY SELECTED. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.



Fossil Records… Evolution of Whales?

Phiomicetus anubis

evolution

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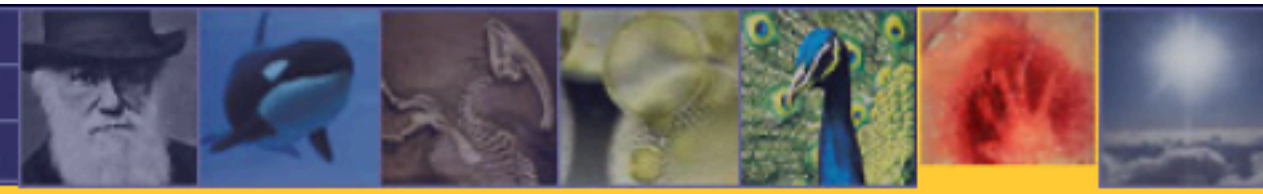

humans

ORIGINS OF HUMANKIND 6 million years ago (mya) to present key: ■ fossil ▲ culture

To move through the timeline

Move the cursor over the small blue left and right arrows.

Or, starting in the upper left corner, click and drag the blue rectangle.

To learn about hominids

Click on the text, the orange squares, and the green triangles.

Or click on the hominid family tree and species gallery buttons below.

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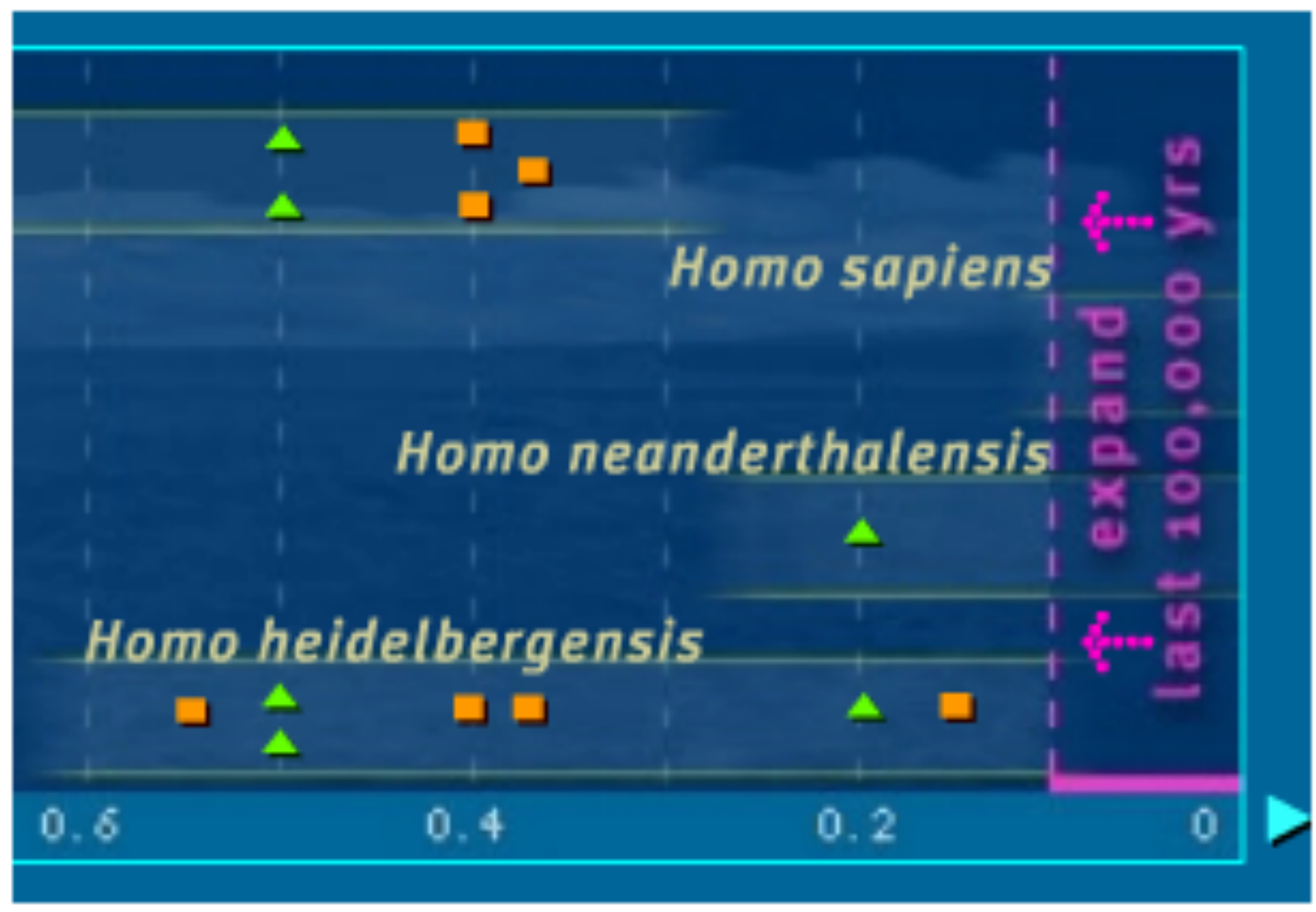

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By **Melissa Hogenboom**
29th January 2020

In many ways, the last surviving Neanderthals are a mystery. But four caves in Gibraltar have given an unprecedented insight into what their lives might have been like.

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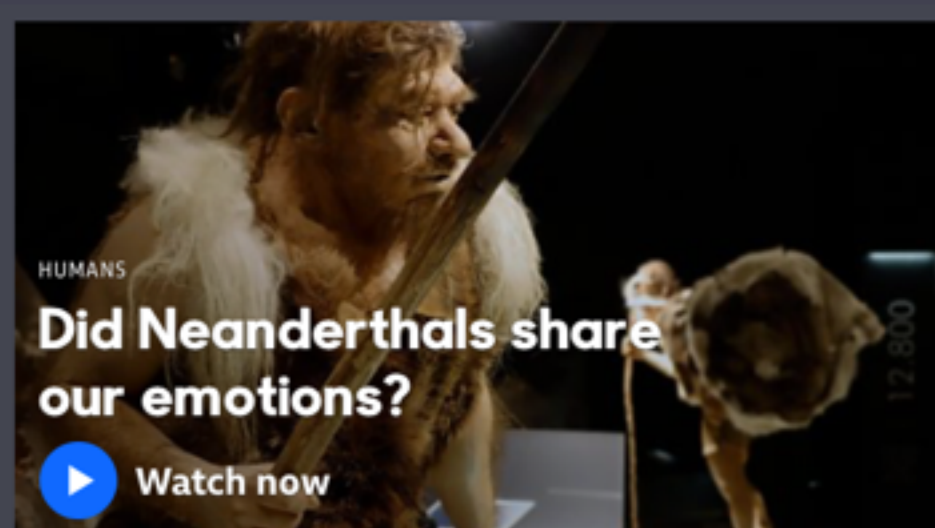
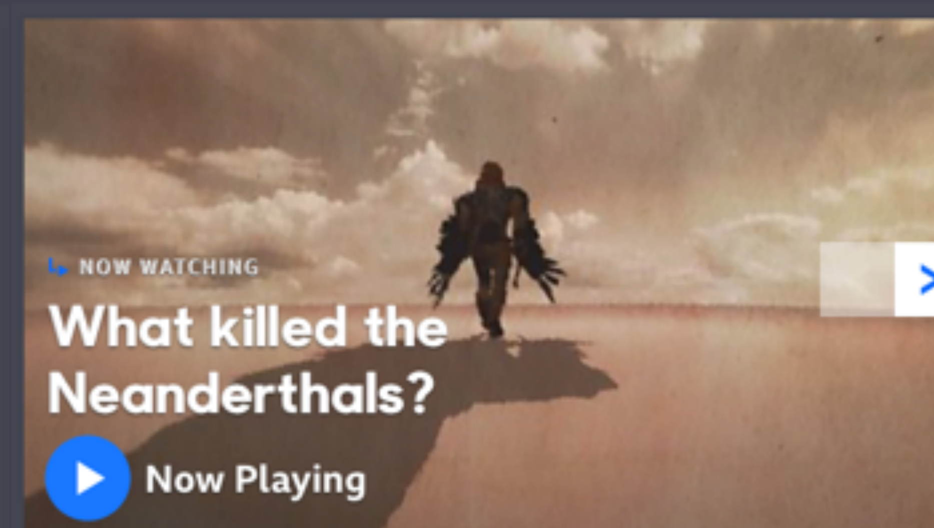
The Last Neanderthal

A special video series telling the real story of how our extinct relative lived and died.





https://www.bbc.com/reel/video/p07y92vt/did-neanderthals-feel-the-same-emotions-as-us-

https://www.bbc.com/reel/video/p041bkpy/find-out-what-really-killed-the-neanderthals

Neanderthals and Homo Sapiens Shared This Cave 50,000 Years Ago

Researchers suggest humans and Neanderthals communicated, and even introduced tools to one another.

By Sara Novak | May 19, 2022 3:30 PM

(Credit: Gorodenkoff/Shutterstock)

Deep in southern France, near the small town of Malataverne, is a limestone cave called Grotte Mandrin. And it has housed Neanderthal and human history for over 100,000 years. As more of a shelter, the cave withstood the hands of time because of its location. The mistral — a famous French northwesterly wind that blows in each winter from the Gulf of Lion — has covered the cave with layers of dust, frozen in time to preserve what lies beneath.

Carl Linnaeus

Swedish botanist

Carl Linnaeus, also known after his ennoblement as Carl von Linné, was a Swedish botanist, zoologist, and physician who formalised binomial nomenclature, the modern system of naming organisms. He is known as the "father of modern taxonomy". Wikipedia

Born: May 23, 1707, Råshult, Älmhult Municipality, Sweden

Died: January 10, 1778, The Linnaeus Museum, Uppsala, Sweden

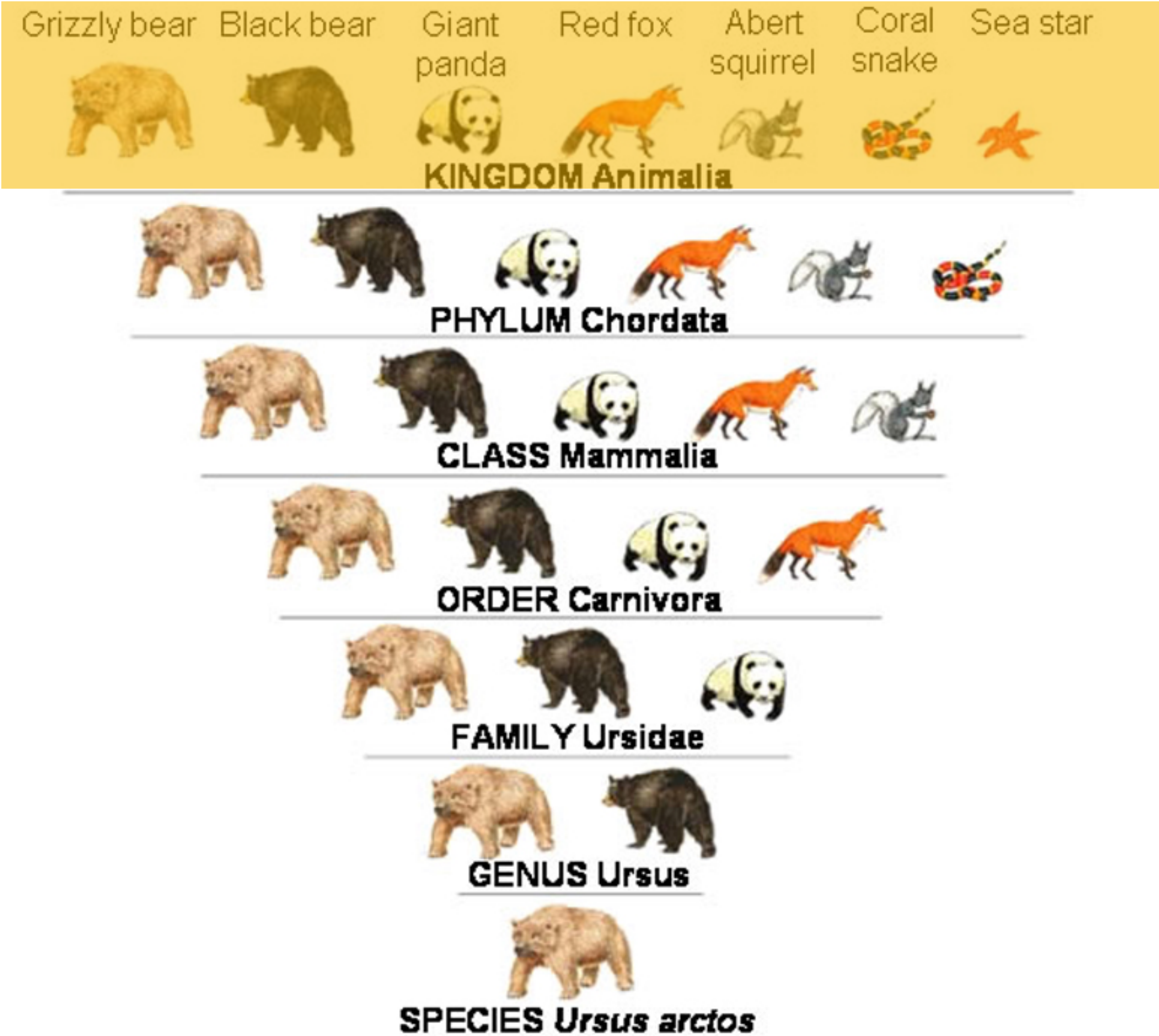
Known for: Binomial nomenclature; Scientific classification; Taxonomy

K P C O F G S

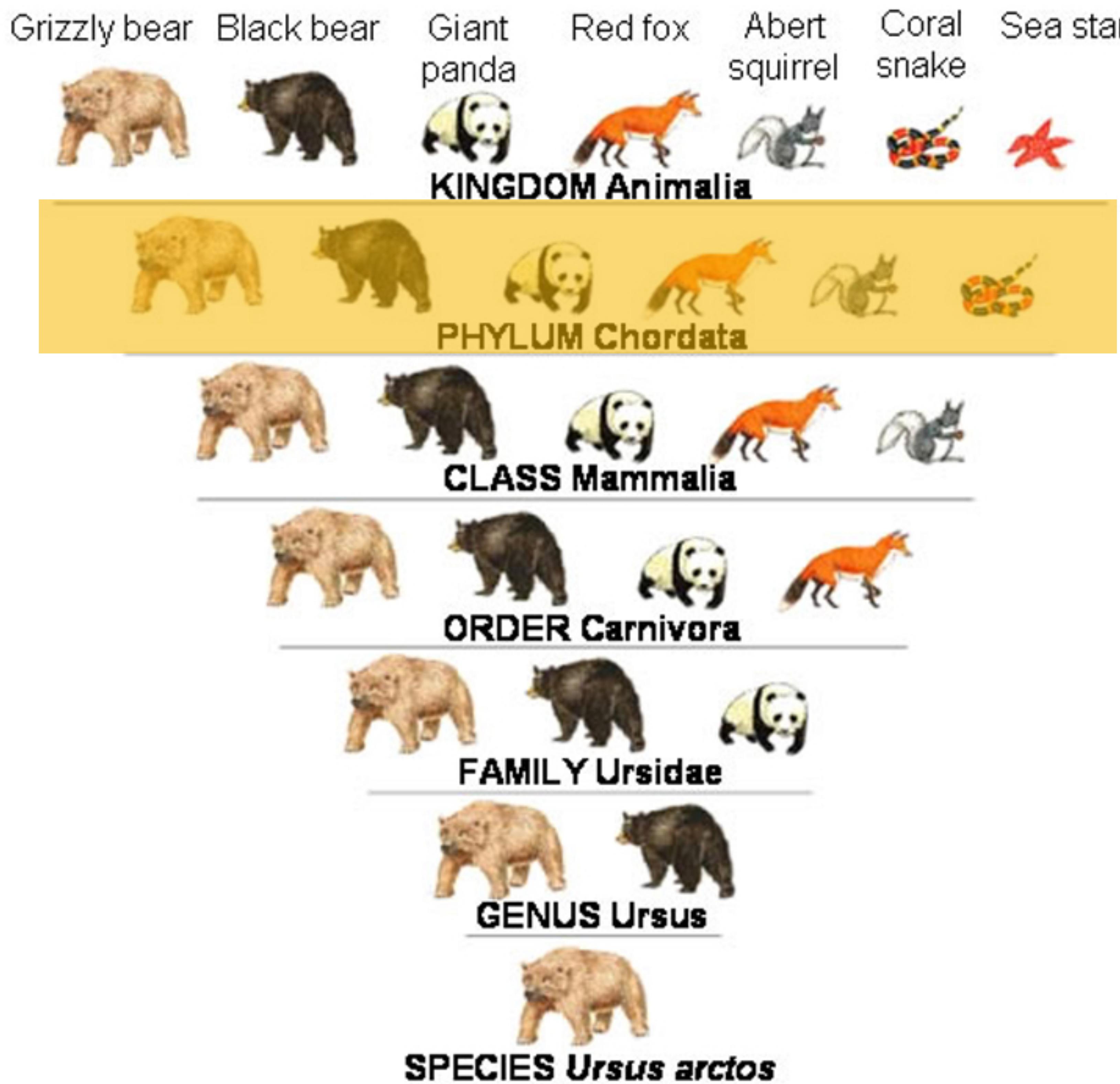
Pidgeon Hole

To pigeon hole: to fairly or unfairly think of or describe (someone or something) as belonging to a particular group, having only a particular skill, etc.

K P C O F G S


Grizzly bear
Black bear
Giant panda
Red fox
Abert squirrel
Coral snake
Sea star
KINGDOM Animalia
PHYLUM Chordata
CLASS Mammalia
ORDER Carnivora
FAMILY Ursidae
GENUS Ursus
SPECIES *Ursus arctos*

K P C O F G S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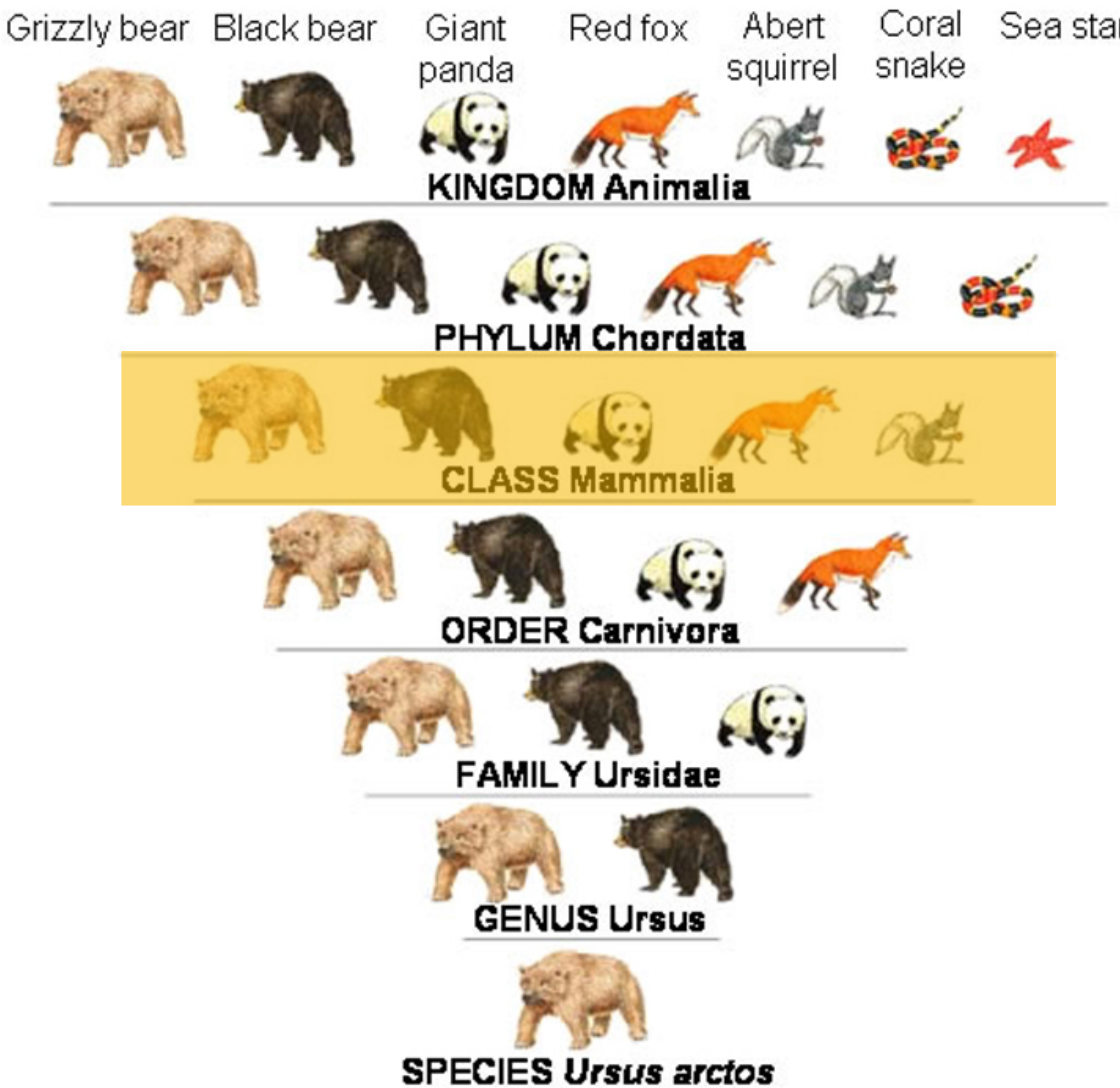
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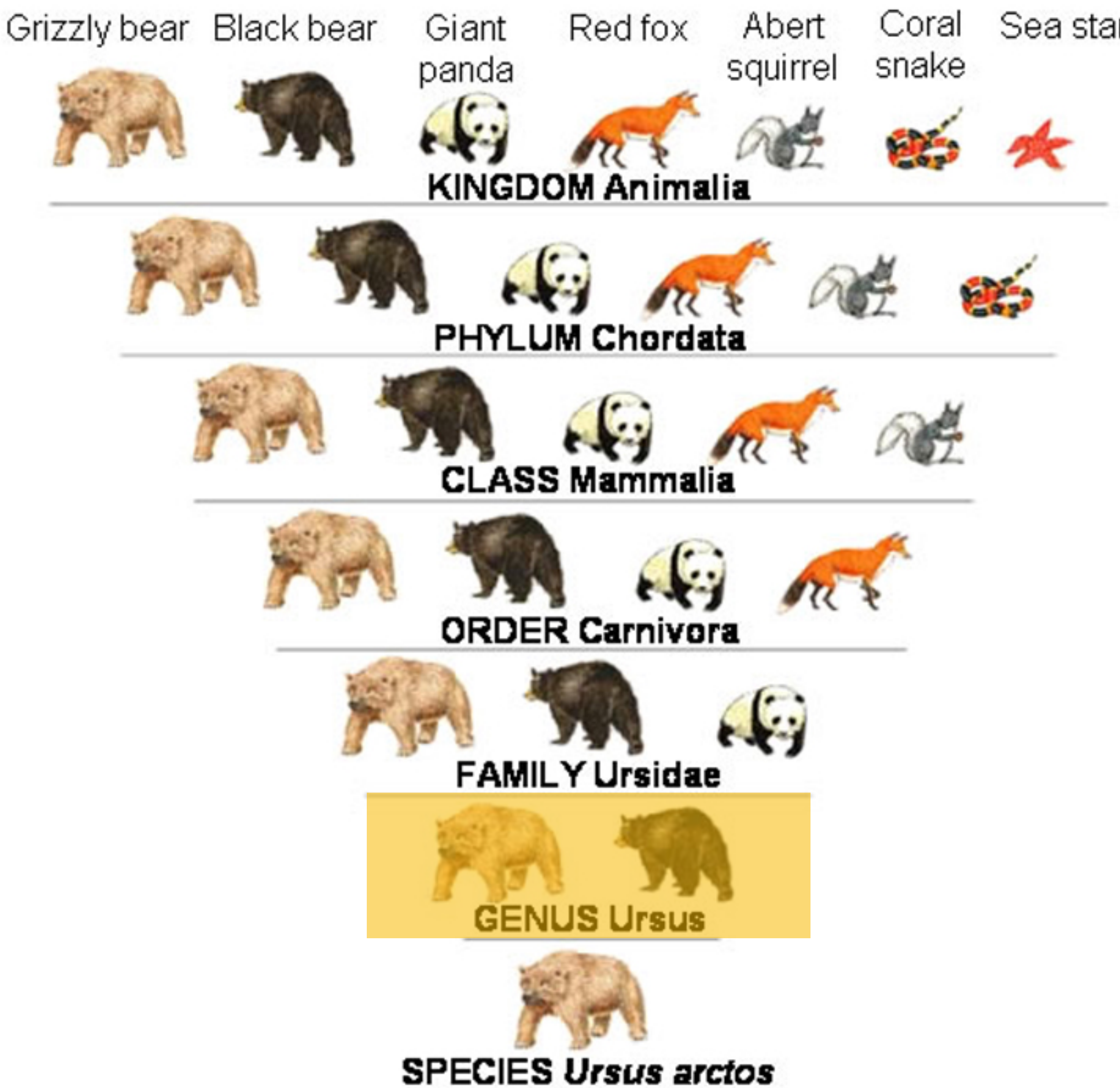
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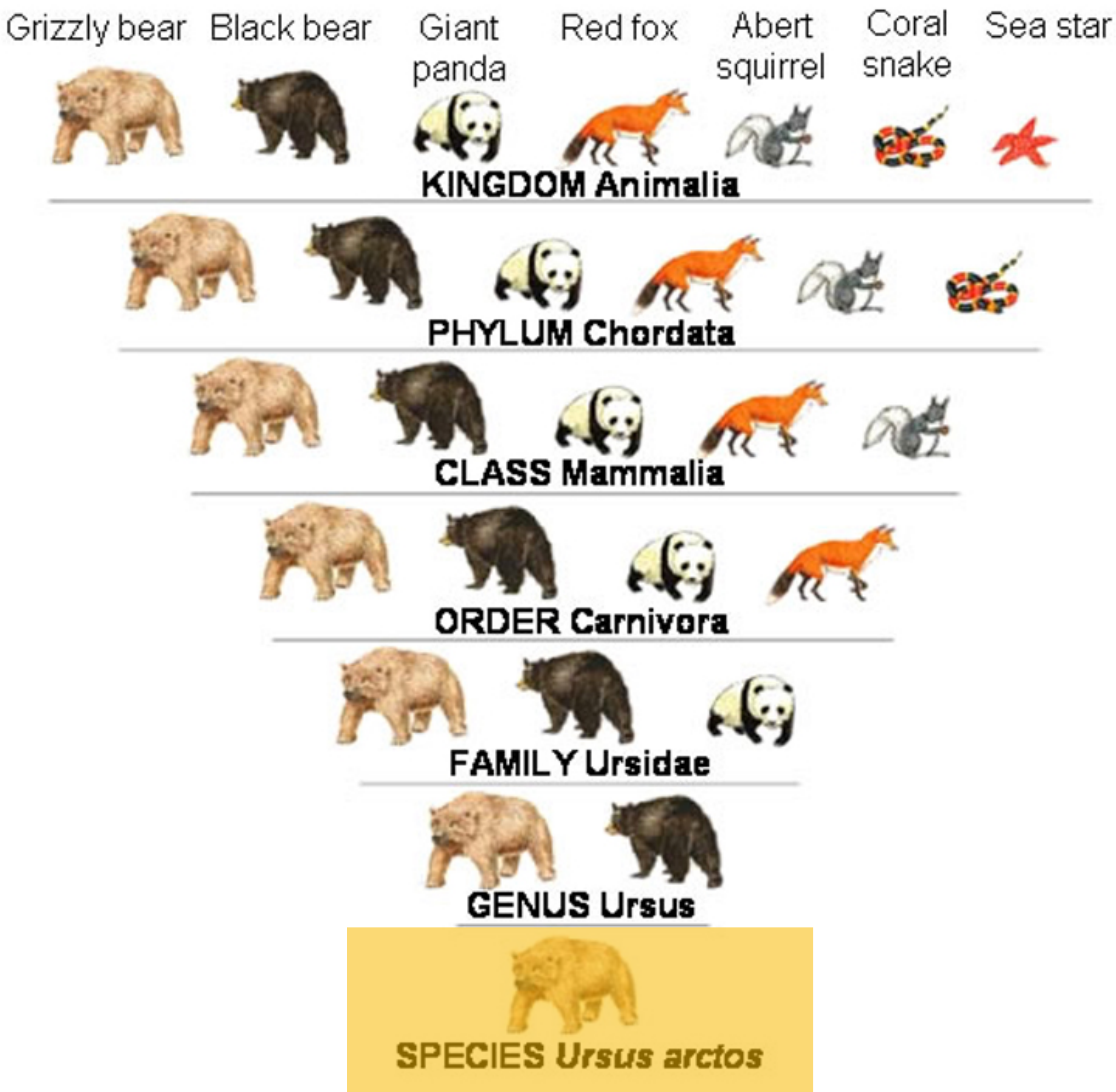
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KPCOFGS (redirected from *Kids Prefer Cheese Over Fried Green Spinach*)

Category filter: Show All (38)

Acronym	Definition
KPCOFGS	Kingdom, Phylum, Class, Order, Family, Genus, Species *(taxonomy order)*
KPCOFGS	Kings Play Chess on Funny Green Squares *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Keep Ponds Clean or Frogs Get Sick *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Kinky People Come Over for Group Sex *(taxonomy order)*
KPCOFGS	King Prawn Curry or Fat Greasy Sausages *(taxonomy mnemonic)*
KPCOFGS	Kings Play Cricket on Flat Green Surfaces *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Ken Poured Coffee on Fran's Good Shirt *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Kids Playing Cards on Freeways Get Smashed *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Kingdom Phylum Class Order Family Genus Species King Philip Can Only Find Green Socks *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Kids Pick Candy over Fancy Green Salads *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Kids Playing Chess on Freeways Get Smashed *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	Keep Paying Casey Off For Gun Sales *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*
KPCOFGS	King Paul Cried Out for Good Soup *(mnemonic for taxonomy order: Kingdom, Phylum, Class, Order, Family, Genus, Species)*

Black Widow Spiders

(A)

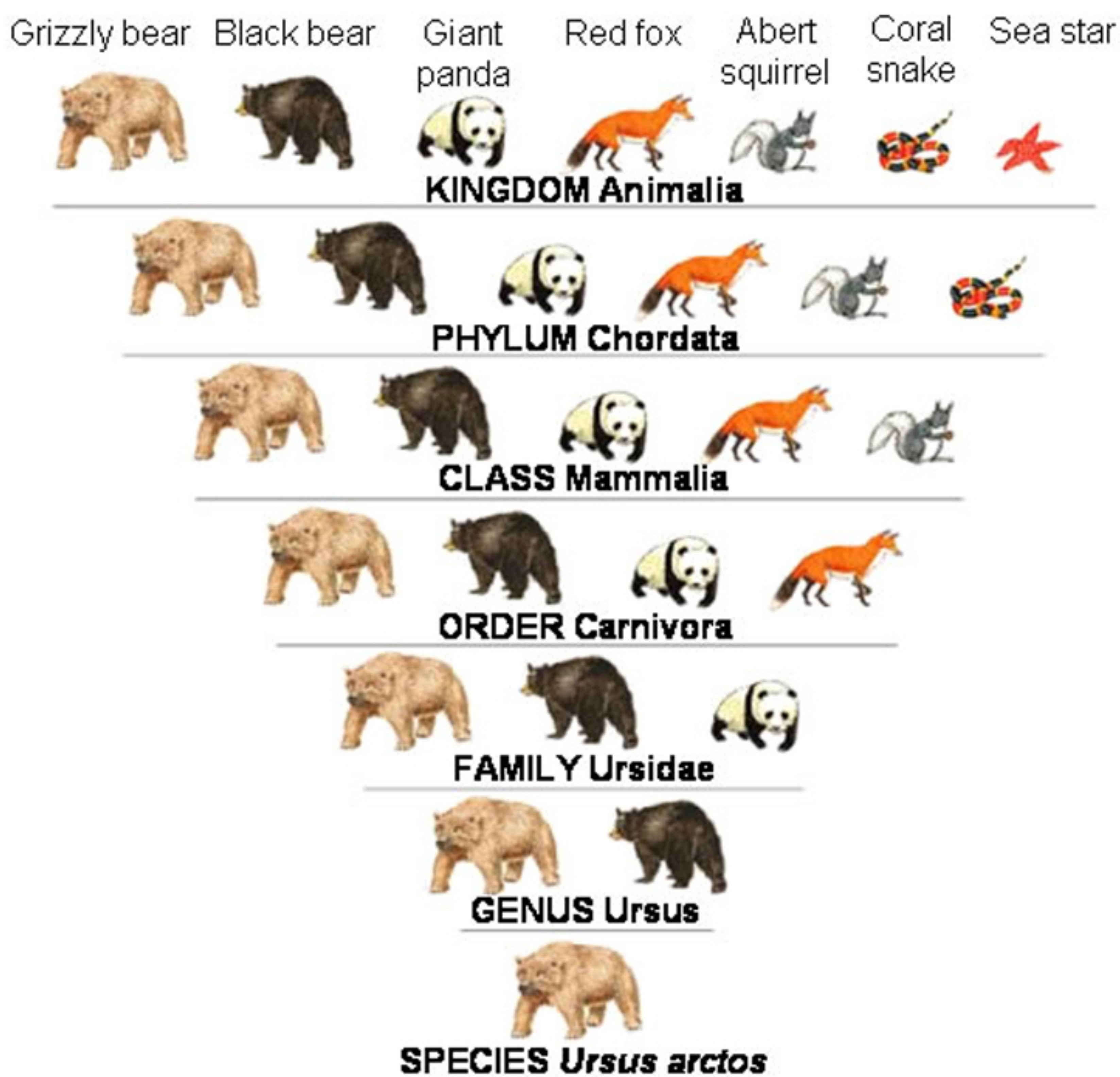
Agelaius phoeniceus
Male, New York

Agelaius phoeniceus
Male, British Columbia

***LIFE 9e*, Figure 23.1**

(a) Similarity between different species. **The eastern meadowlark (*Sturnella magna, left*) and the western meadowlark (*Sturnella neglecta, right*) have similar body shapes and colorations. Nevertheless, they are distinct biological species because their songs and other behaviors are different enough to prevent interbreeding should they meet in the wild.**

K P C O F G S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PHYLUM Chordata
CLASS Mammalia
ORDER Carnivora
FAMILY Ursidae
GENUS Ursus
SPECIES *Ursus arctos*

How many kingdoms are there….?

(A) 3,
(B) 4,
(C) 5,
(D) 6,
(E) 8.

Monera / Archaea / Protista / Fungi / Plantae / Animalia /

Insecta / Panera / Pianera / Protozoa

Insect

Animal

Insects or Insecta are hexapod invertebrates and the largest group within the arthropod phylum. Definitions and circumscriptions vary; usually, insects comprise a class within the Arthropoda. As used here, the term Insecta is synonymous with Ectognatha. Wikipedia

Eaten by: Mantis

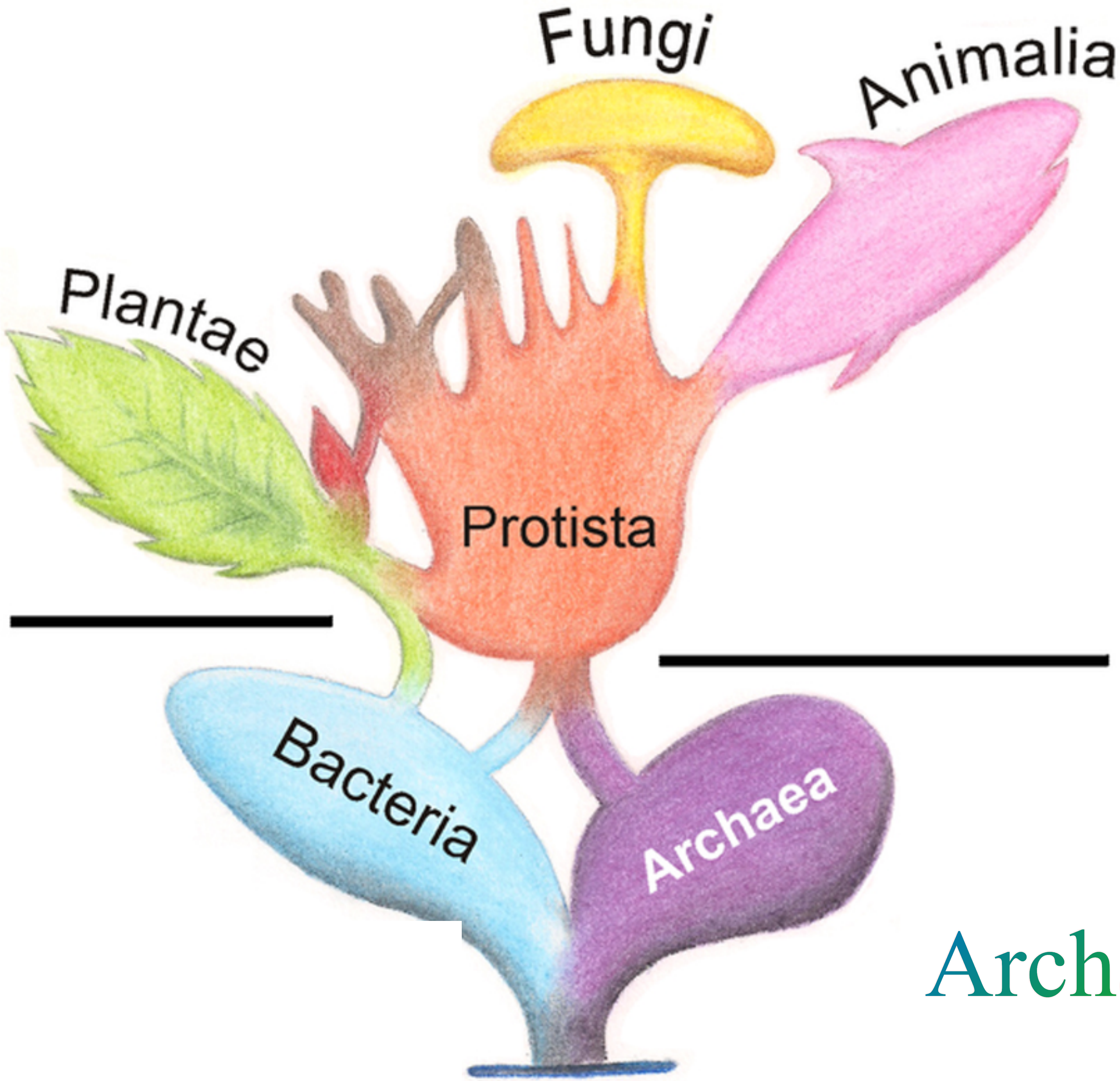
Class: Insecta; Linnaeus, 1758

Kingdom: Animalia

Scientific name: Insecta

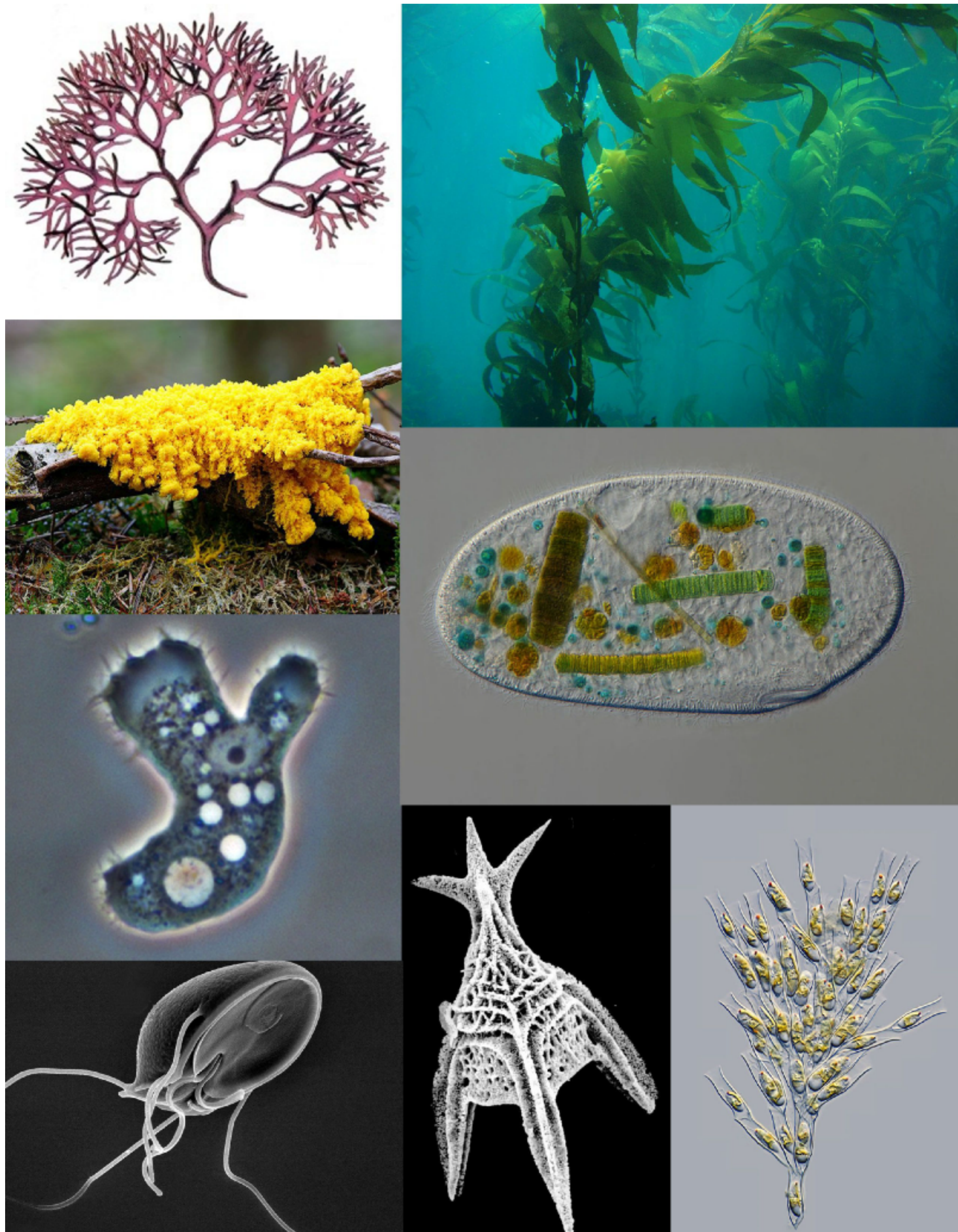
Phylum: Arthropoda

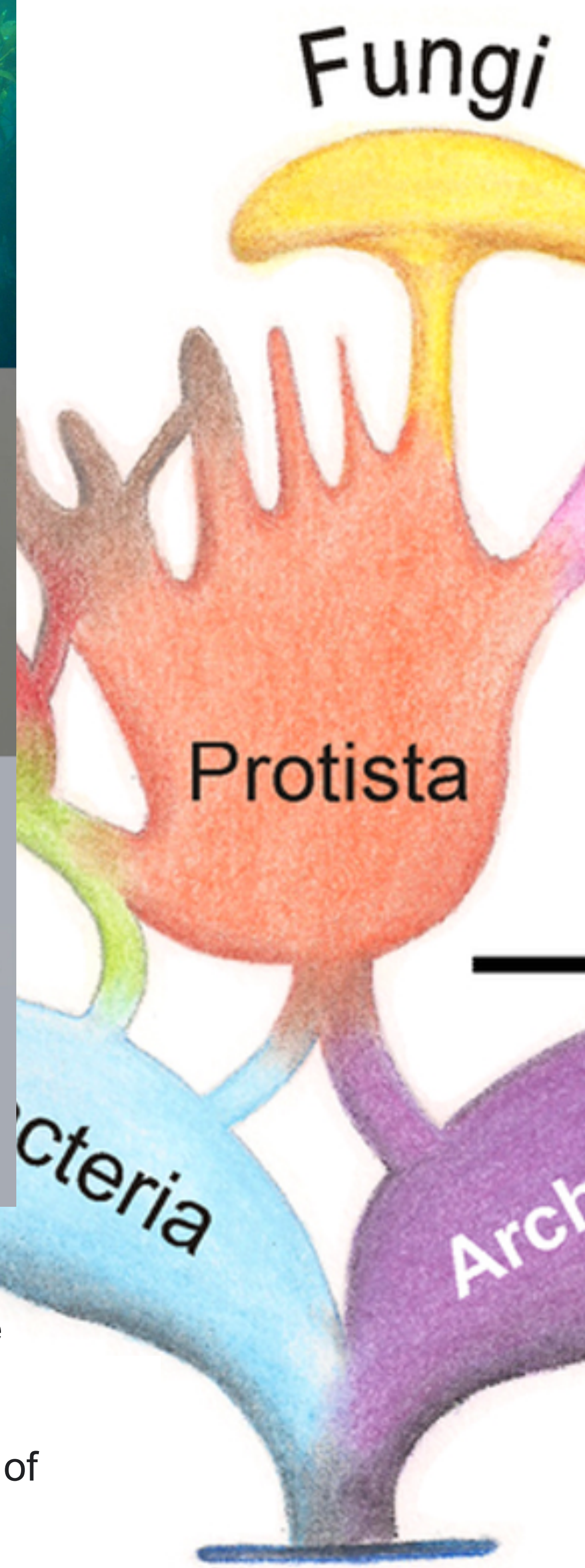
Rank: Class

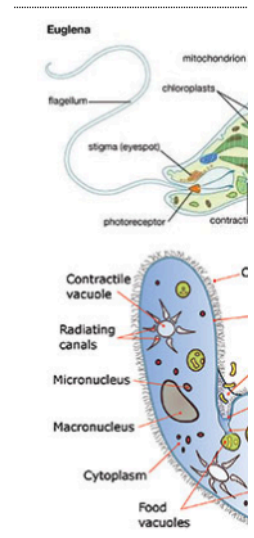


Archaea

Do Kids Prefer Cheese Over Fried Green Spinach ??






Protozoa may be
colonies, without

Some of the char

1. There are about 50,
2. Protozoans exhibit r
   (ectoparasites or en
3. They are **small**, usu
4. They are the **simple**
5. They have a simple
6. The body is **unicellu**
7. They have one or m

Insects or Insecta are pancrustacean hexapod invertebrates and the largest group within the arthropod phylum. Insects have a chitinous exoskeleton, a three-part body, three pairs of jointed legs, compound eyes and one pair of antennae. Wikipedia

Legs: six legs ny.gov

Class: Insecta; Linnaeus, 1758

Kingdom: Animalia

Phylum: Arthropoda

Clade: Pancrustacea

Subphylum: Hexapoda

Protista is **a large complex grouping of mostly unicellular eukaryotic organisms**. They are morphologically diverse and can be found in most terrestrial, aquatic, and marine habitats as free-living forms and as parasites of other protists, of fungi, and of plants and animals. eg. algae, amoeba euglena etc.

Do **K**ids **P**refer **C**heese **O**ver **F**ried **G**reen **S**pinach

Domains and Kingdoms of Life

https://www.youtube.com/watch?v=F38BmgPcZ_I

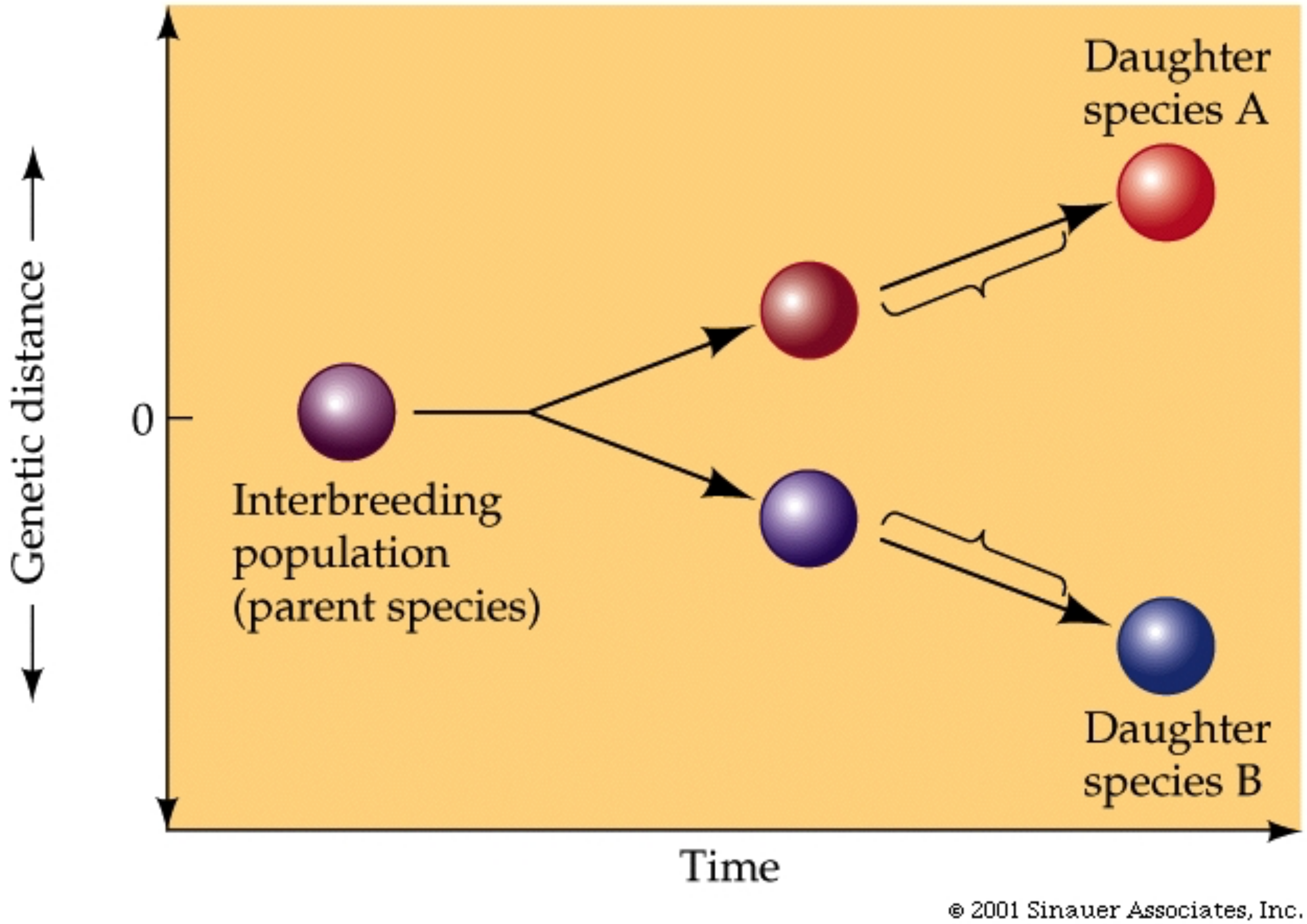
While most of the Linnaean taxonomic grouping was in place long before Darwin, after Darwin this classification scheme needed significant refinement on precisely what was meant by each of the terms, (especially the term "Species")

"**Species** are groups of interbreeding (or potentially interbreeding) natural populations which are reproductively isolated from other such groups."

Genetic integration works on the premise that "if individuals within a population mate with one another, but not with individuals of other populations, this population can be considered to be an **"independent evolutionary unit"**, and can safely be called a **Species**

" ...the smallest groups that are consistently and persistently distinct and distinguishable by ordinary means."

Morphological **S**pecies **C**oncept (**MSC**) -Cronquist 1988



Speciation is the process by which one "species" splits into two.

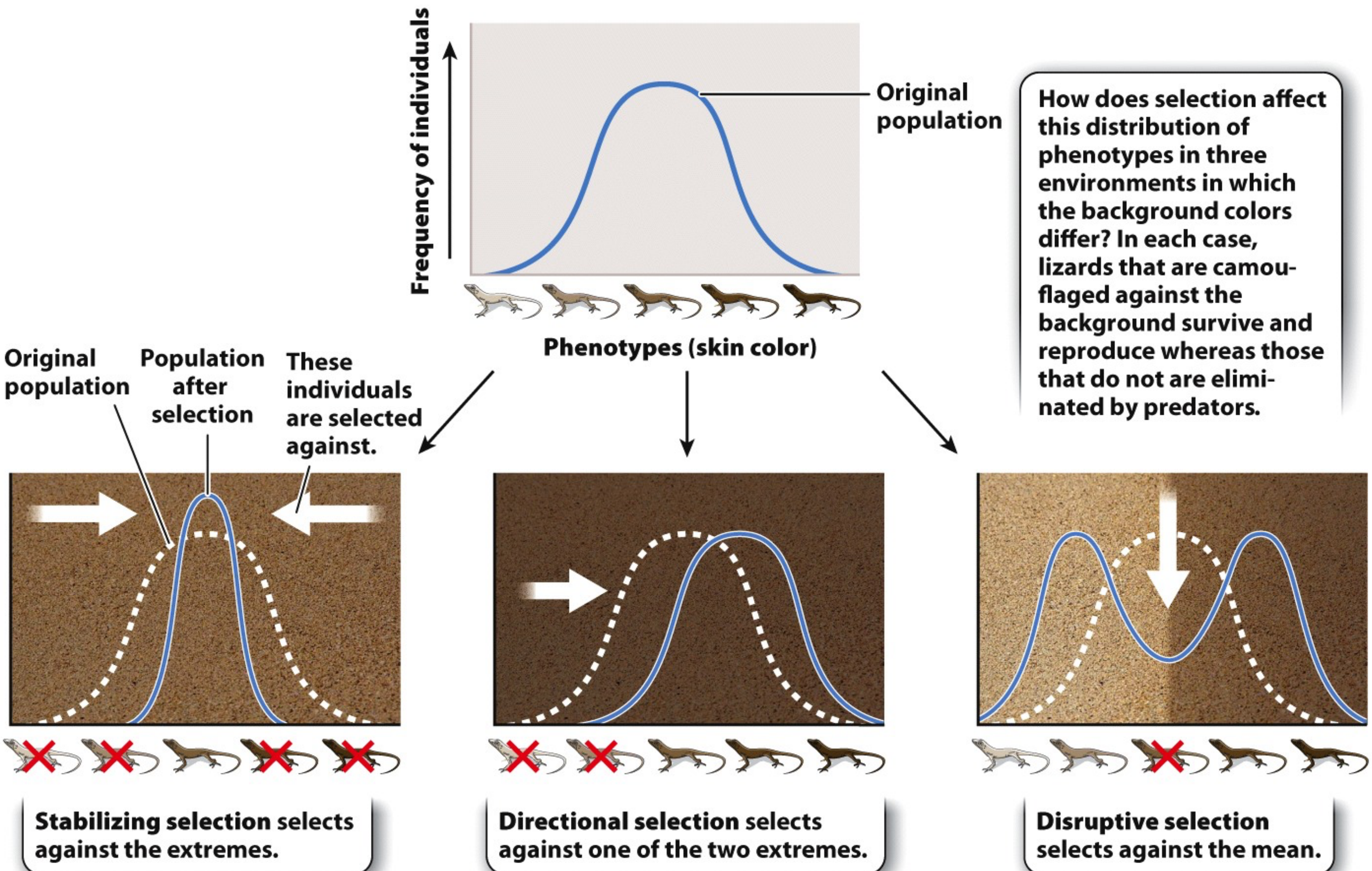


Figure 21.9
Biology: How Life Works

Allopatric speciation requires total genetic "reproductive" isolation.....or, when two or more parts of a single population become divided by a geographic barrier, alternatively known as **geographic speciation**.

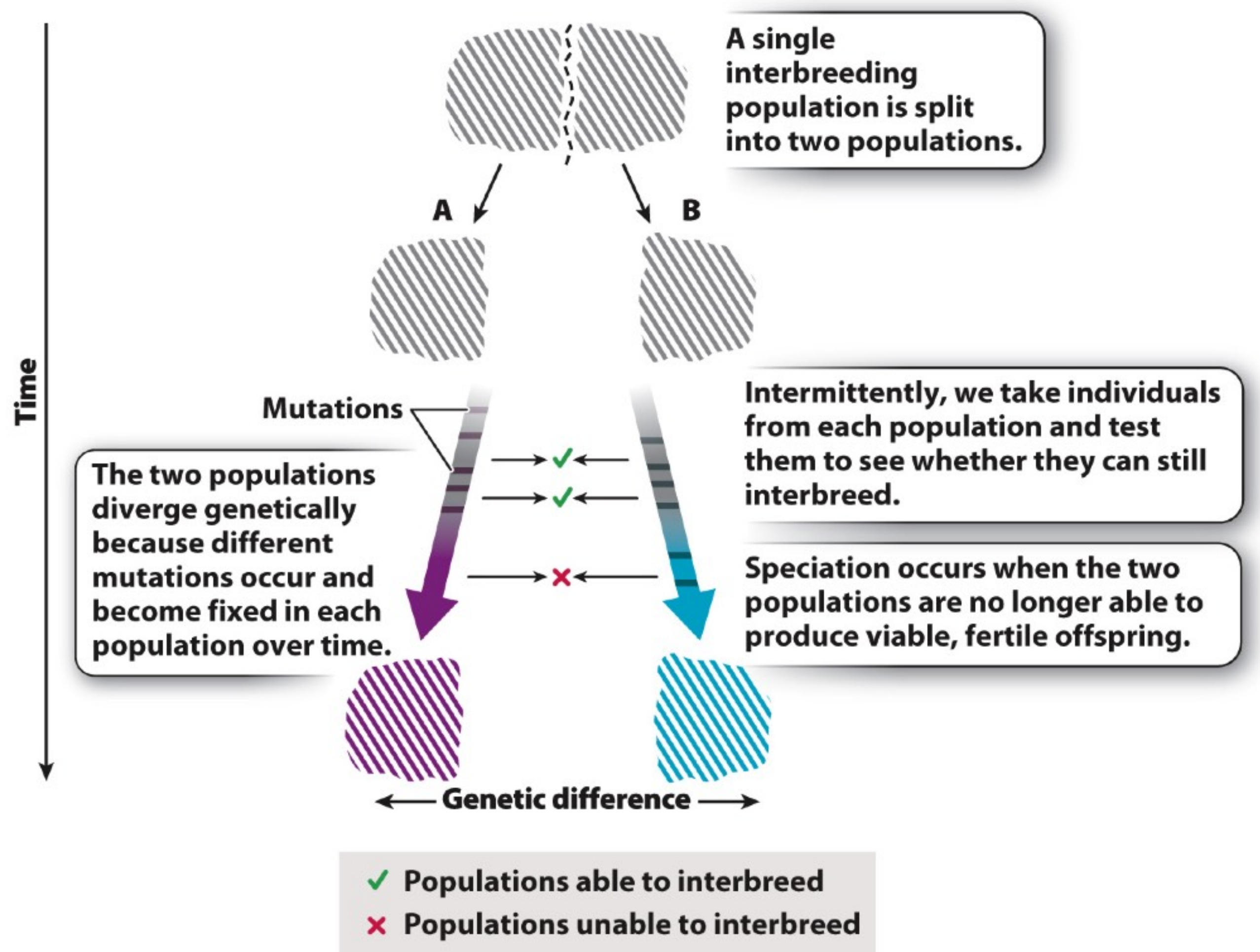


Figure 22.6
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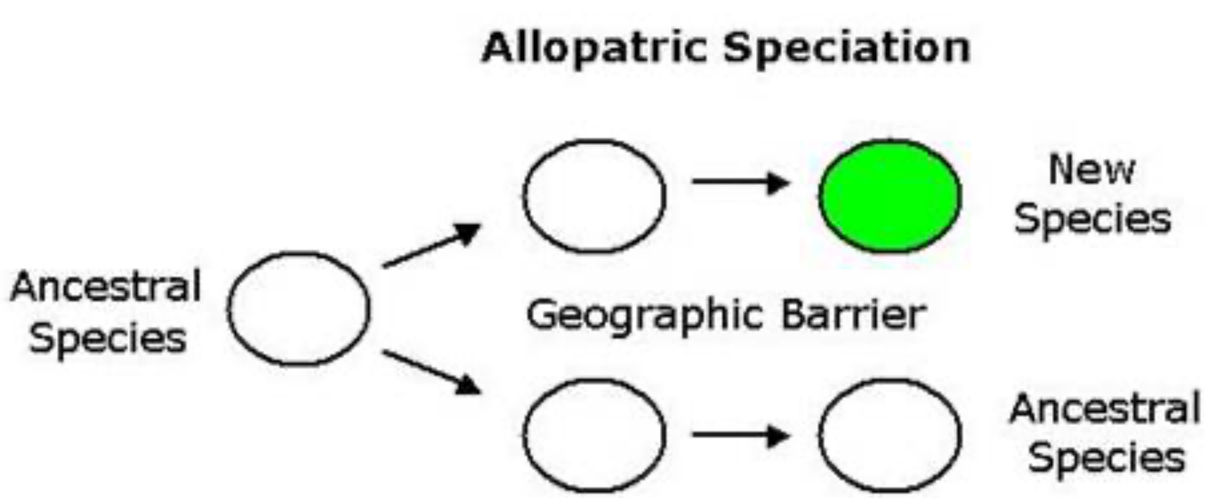
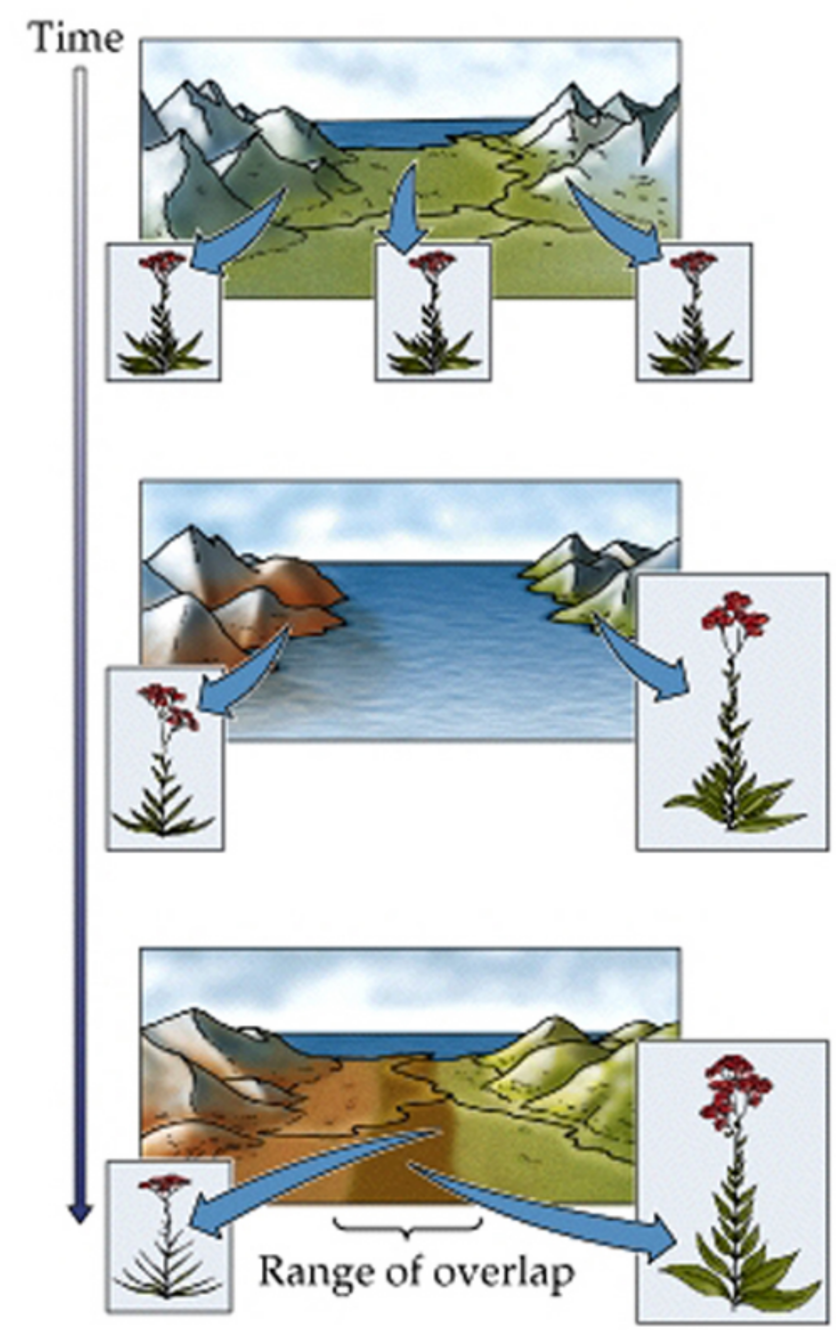
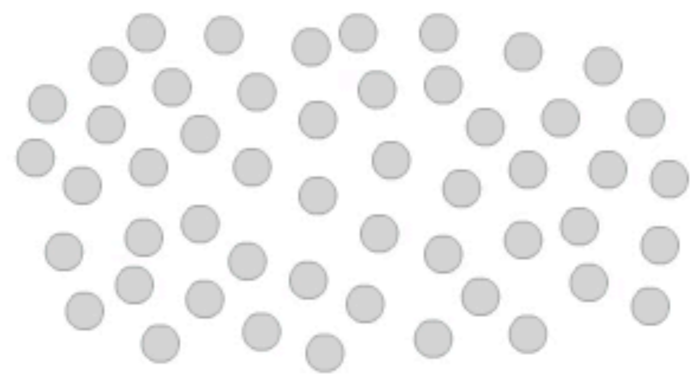




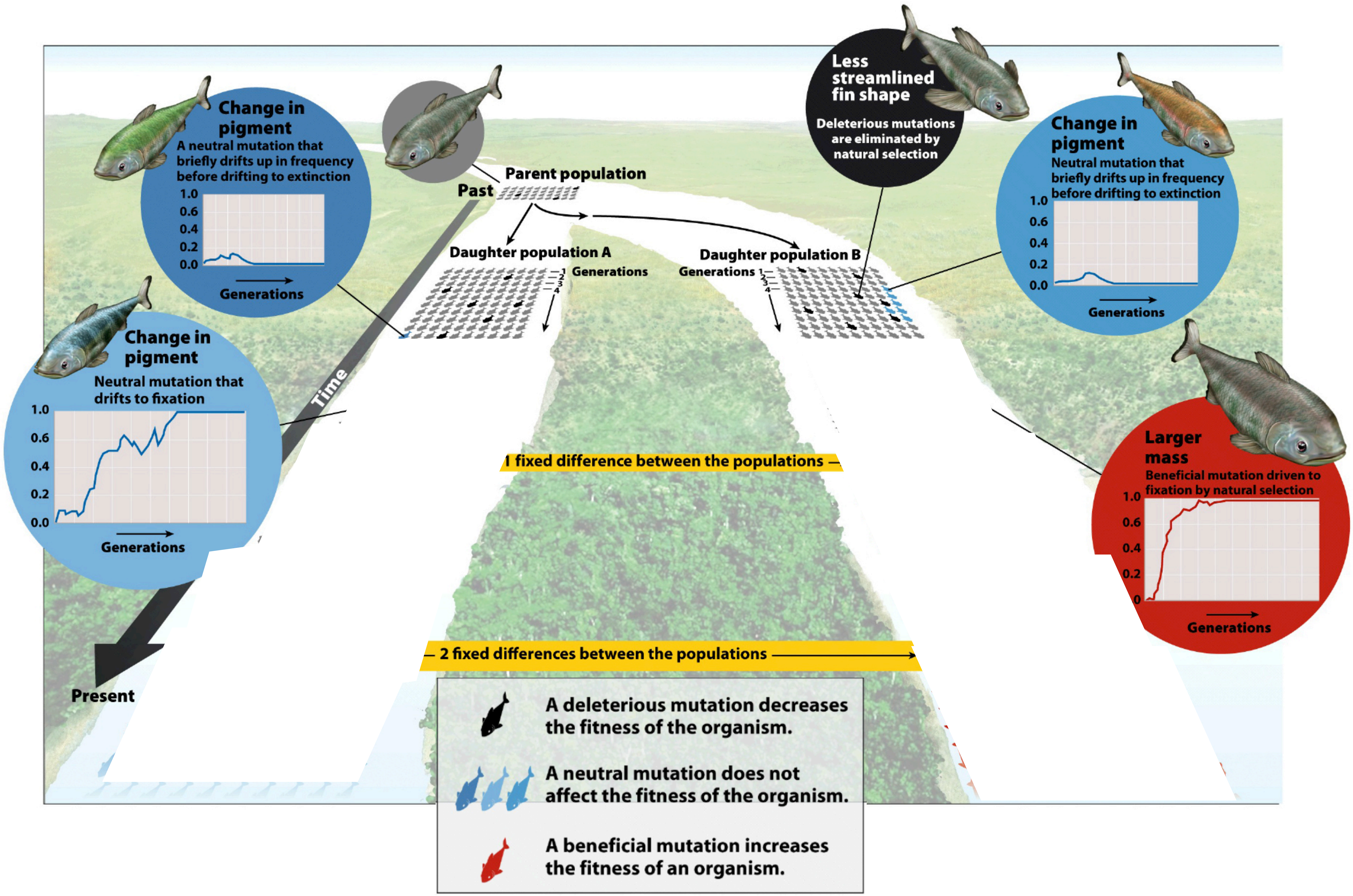
Speciation

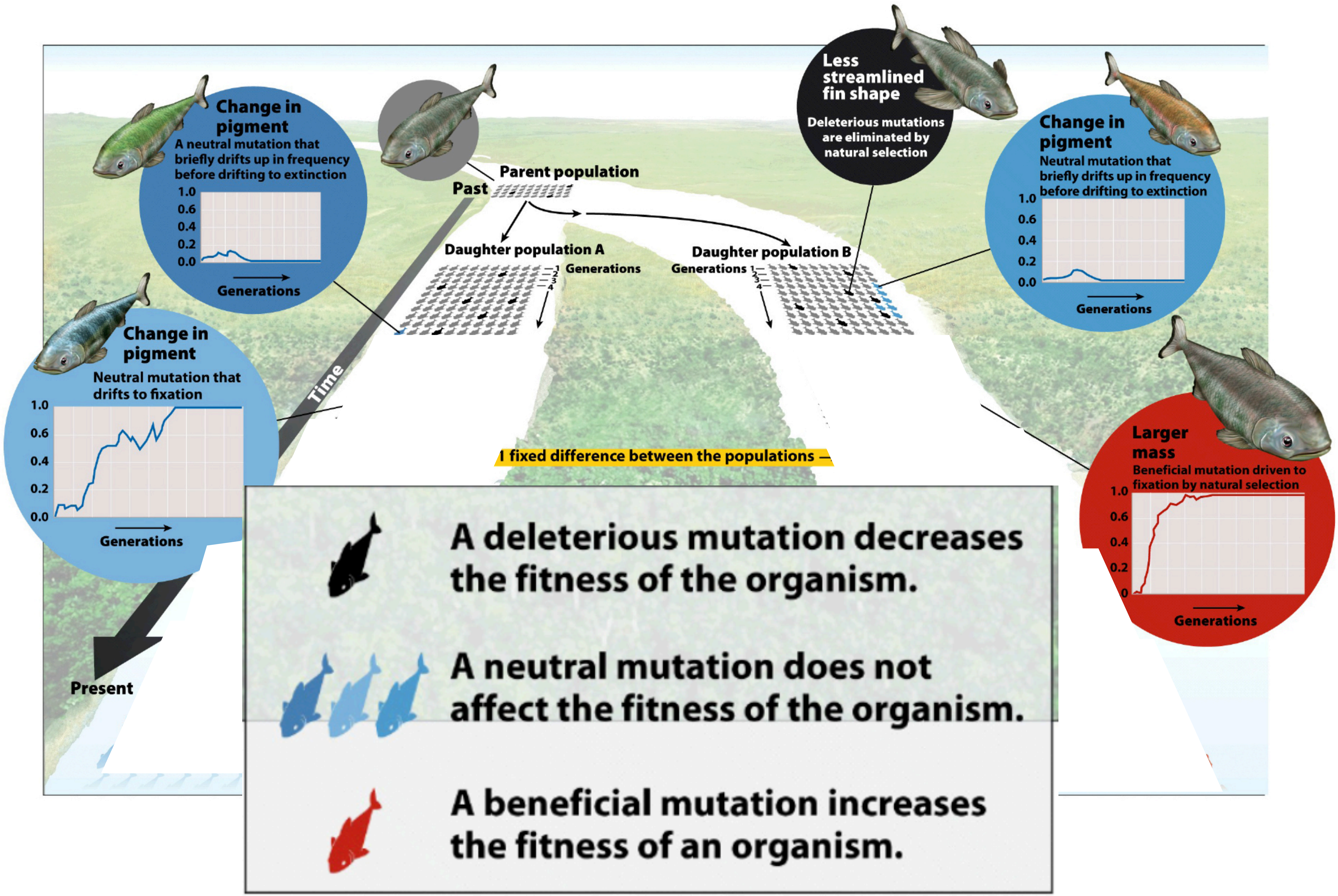
Speciation



1
Generation

We will track the evolution of this population through time.


Change in pigment
A neutral mutation that briefly drifts up in frequency before drifting to extinction
1.0
0.6
0.4
0.2
0.0
Generations
Parent population
Past
Less streamlined fin shape
Deleterious mutations are eliminated by natural selection
Change in pigment
Neutral mutation that briefly drifts up in frequency before drifting to extinction
1.0
0.6
0.4
0.2
0.0
Generations
Daughter population A
Generations
1
2
3
4
Daughter population B
Generations
1
2
3
4
Change in pigment
Neutral mutation that drifts to fixation
1.0
0.6
0.4
0.2
0.0
Generations
Time
Larger mass
Beneficial mutation driven to fixation by natural selection
1.0
0.6
0.4
0.2
0
Generations
1 fixed difference between the populations
2 fixed differences between the populations
Present
A deleterious mutation decreases the fitness of the organism.
A neutral mutation does not affect the fitness of the organism.
A beneficial mutation increases the fitness of an organism.



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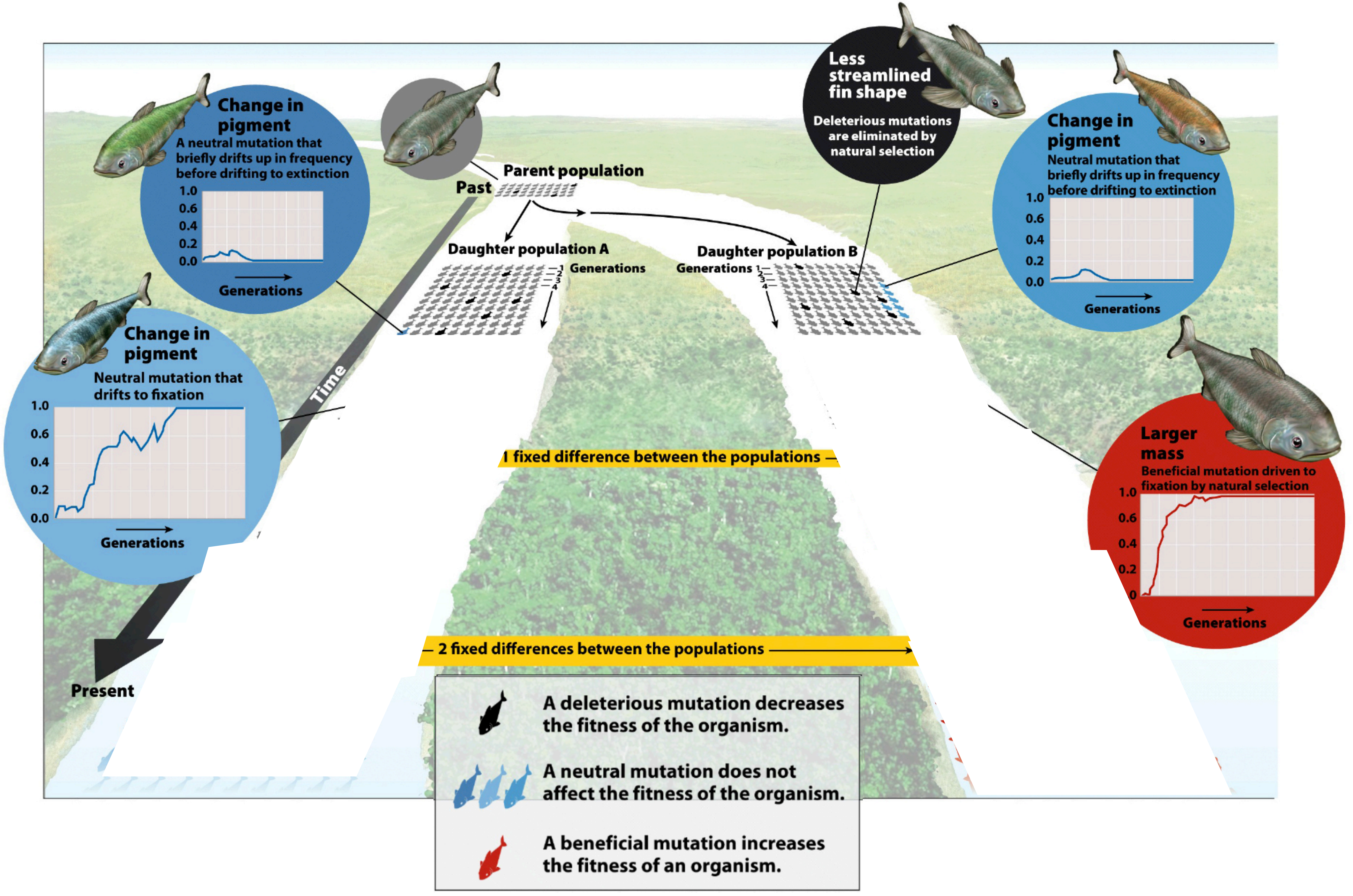

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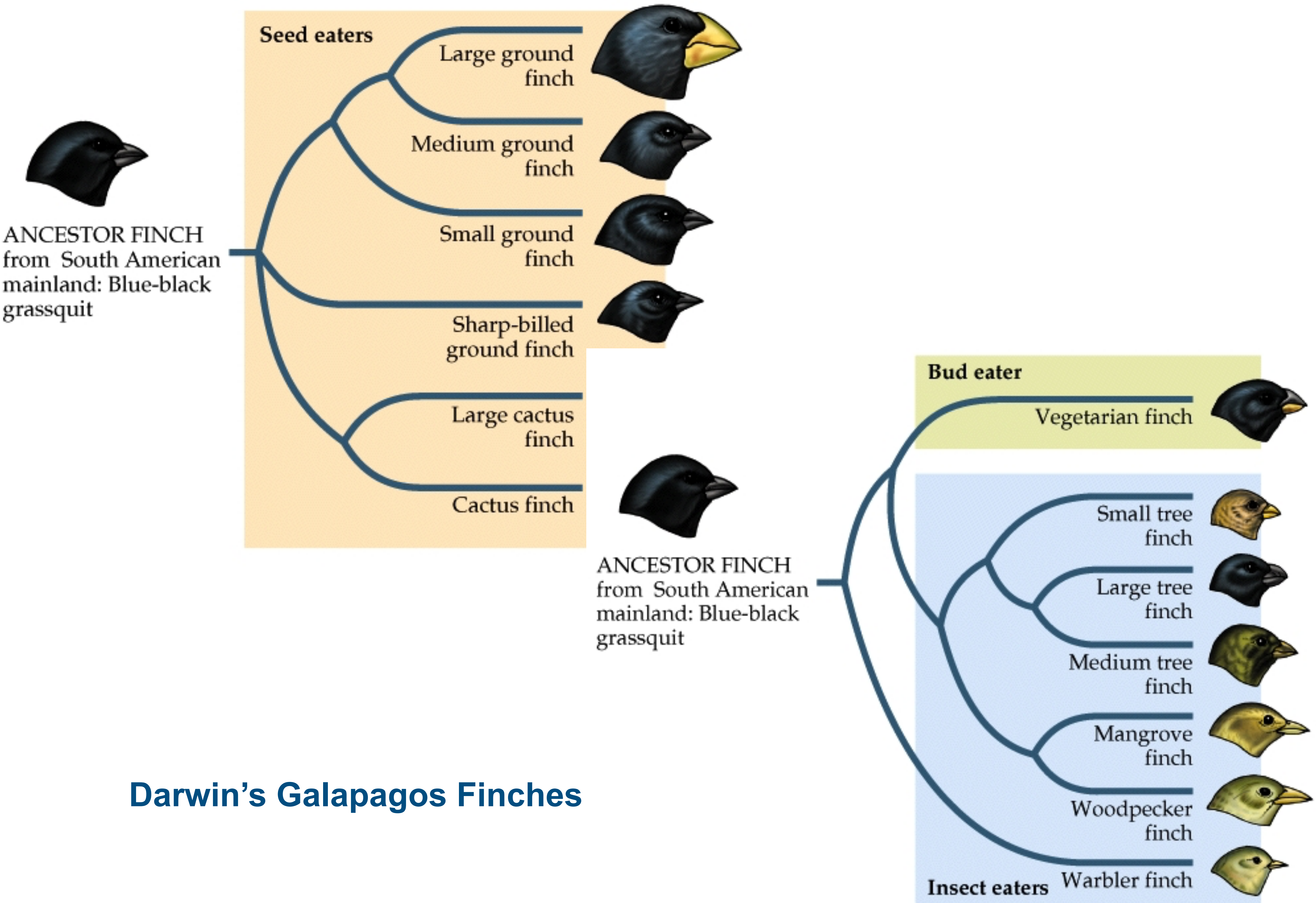

Darwin's Galapagos Finches

 

American and European Sycamores

Sympatric speciation is the evolution of a new species from a surviving ancestral species while both continue to inhabit the **same geographic region**.

Fruit flies have speciated sympatrically in New York State for more than a hundred years. These fruit flies originally courted, mated, and deposited eggs only on **hawthorn fruits.**

About 170 years ago, large commercial **apple orchards** were planted in New York. Some fruit flies began to lay their eggs on the apple trees, perhaps by mistake. Consequently, their offspring sought out apple trees as adults and, therefore, mated with other fruit flies of similar heritage.